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for the Behavioral and Social Sciences**

Research Report 1739

**The Commanders' Integrated Training Tool for the
Close Combat Tactical Trainer: Design, Prototype
Development, and Lessons Learned**

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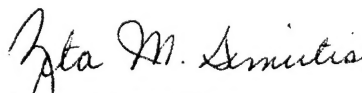
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FOREWORD

The use of simulations in U.S. Army training continues to increase, as does the need for tools and techniques for exploiting simulation capabilities. The U.S. Army Research Institute has led the development of structured training approaches providing such tools and techniques, primarily through work accomplished in the Armored Forces Research Unit (AFRU) at Fort Knox, Kentucky. Experience with structured simulation-based training has led to the recognition of a need to provide a comprehensive system to "train the trainer." The Close Combat Tactical Trainer (CCTT) magnifies this need since an experienced full-time training team is not provided to conduct training. Commanders and other trainers need to understand the capabilities of the CCTT, and be able to customize structured training to maximize the benefit of the CCTT in their unit training strategy.

This report describes the design, prototype development, and formative evaluation of computer software that assists commanders or other unit trainers to develop and manage structured CCTT training. This effort was entitled "Commanders Integrated Training Tool (CITT) for the Close Combat Tactical Trainer." The AFRU accomplished this effort as part of Work Package 2124, "Strategies for Training and Assessing Armor Commanders' Performance with Devices and Simulations (STRONGARM)." The relevant requirements document is a Memorandum for Record between the AFRU and the Project Manager for the Combined Arms Tactical Trainer (PM CATT), entitled "Structured Training for the Close Combat Tactical Trainer," dated 25 July 1997.

The CITT software design and prototype have been provided to the US Army Training Support Center, and to the PM and the Training and Doctrine Command System Manager for CATT. The CCTT instructional overviews developed are available on videotape and on an Internet Web-site to inform senior leaders and unit trainers about the capabilities of the CCTT and structured training. This report documents the methods and lessons learned in CITT design, and in developing and formatively evaluating the prototype. It will be useful to individuals and agencies involved in the development and implementation of Army training management systems for live, virtual, or constructive training environments.


ZITA M. SIMUTIS
Technical Director

ACKNOWLEDGEMENTS

This project reflects the efforts of a team of computer programmers, performance analysts, training developers, simulation systems experts, and administrative support personnel. During the course of the 14-month effort to develop the Commanders' Integrated Training Tool (CITT), a number of personnel from the Army Research Institute for the Behavioral and Social Sciences (ARI) and contractor personnel were involved in design, development, implementation, and evaluation. The CITT Team included contractor personnel from five organizations: the Human Resources Research Organization, Raytheon, TRW, Via Internet Studio, and Litton PRC. Extra technical support came from staff at SHERIKON, Inc., and AcuSoft in Orlando. Mr. Bill Myers (TRW) provided additional design guidance and leadership early in the project. Much of the project could not have been accomplished without the stellar support provided by Ms. Peggy Salmon, the project's administrative assistant and Ms. Kari Knight, our graphic artist and multimedia specialist.

Additionally, we had support and guidance from a variety of individuals and government organizations, including:

- TRADOC System Manager (TSM) for the Combined Arms Tactical Trainer (CATT)
Colonel Louis Gelling, Jr.
Lieutenant Colonel Jeff Wilkinson
- 16th Cavalry, Fort Knox
Colonel Michael D. Jones, Commander
- 1st Armor Training Brigade, Fort Knox
Colonel Scott R. Feil, Commander
- Directorate of Training and Doctrine Development
Colonel William J Blankmeyer, Director
- 1st Squadron, 7th Cavalry, Fort Hood
Lieutenant Colonel A. Ierardi, Commander
- 2/172 Armor, Vermont National Guard
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- 4th Cavalry Brigade (TSB)
Colonel Patrick Ritter, Commander
- The Army Training Support Center (ATSC)
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- Fort Knox Television
Ms. Paula Olive, Chief

Personnel within the units and agencies listed above provided exceptional support to the project team through detailed product reviews, as evaluation participants, and as actors in the two instructional videos. Without their assistance, the CITT Project would not have accomplished its objectives. A special thanks goes to Greg Story (PULAU Electronics, Inc.) and the CCTT site staff at Fort Knox. They provided outstanding support throughout the project to include information, system access and technical assistance.

THE COMMANDERS' INTEGRATED TRAINING TOOL FOR THE CLOSE COMBAT TACTICAL TRAINER: DESIGN, PROTOTYPE DEVELOPMENT, AND LESSONS LEARNED

EXECUTIVE SUMMARY

Research Requirement:

The U.S. Army is currently fielding the Close Combat Tactical Trainer (CCTT) as the first member of the Combined Arms Tactical Trainer (CATT) family. The CCTT provides a virtual environment supporting the collective training of armored and mechanized infantry units. To maximize its effectiveness, the CCTT will be fielded as a complete, integrated training system, i.e., in addition to the basic hardware and software that comprise the system, it will also provide the tools required to enable its users to achieve maximum benefit from its use. As CCTT training tools, techniques, and procedures have evolved, the need has increased for integrating them so that commanders and other unit trainers can access and use them readily and effectively. Such an integrating system or tool should: (a) provide trainers with ready access to all the information and methods they need to exploit the emerging capabilities of CCTT; (b) be compatible with Army training management information systems and databases; (c) lead users to effective and efficient methods for developing and implementing training by providing ready access to available exercises, associated Training Support Packages (TSPs) and other materials; (d) provide users with an understanding of and means to apply a structured approach to meeting training requirements; and (e) address the training of digital forces.

In October, 1997 a project was initiated to address the design and development of a tool having the characteristics described above. The tool is the Commanders' Integrated Training Tool (CITT) for the CCTT. The overall purpose of the project was to design the CITT system to provide unit commanders and other unit trainers with the capability to maximize the effectiveness of their unit training in the CCTT virtual trainer. The CITT design would allow commanders to select existing training exercises that match their unit's needs, and if no such exercises exist, to modify existing exercises or develop new ones. Additional purposes of the project were to provide an Instructional Overview (IO) of CCTT including detailed coverage of the principles of structured training for inclusion in the CITT and to serve as the basis for the development of two videotapes; to develop a prototype of the CITT as a proof of concept and to refine the prototype through formative evaluation; to develop implementation methods and fielding recommendations for the CITT; and to record and document lessons learned for application in similar projects.

Procedure:

The project objectives were accomplished through the completion of six research and development tasks. In the first month of the project a comprehensive research and development plan was produced and submitted for ARI approval. Following approval work began on designing the Instructional Overview incorporating CCTT into a training strategy and addressing CCTT training capabilities along with methods for exploiting them. The outcomes of this task served as the basis for the Learn About CCTT module of the CITT prototype and for the

development of two videos. Simultaneously with IO design, design of the CITT was initiated and proceeded throughout the duration of the project. CITT design was accomplished using Army approved design and modeling tools and procedures. When CITT design was sufficiently complete, work on the development of a prototype CITT was initiated. The prototype served as a "proof of concept" and was produced in two versions—a standalone version and a distributed internet accessible version, although the standalone version had substantially greater functionality. Formative evaluation of the prototype was conducted at Fort Hood and Fort Knox, and the results were used to refine the CITT prototype. Refinement of the prototype included the production of user and administrator documentation for both the standalone and distributed versions. In addition, a proposed implementation strategy and fielding plan for the CITT was produced. The final activities of the project involved documenting lessons learned during development of the CITT along with recommendations relating to implementation and fielding.

Findings:

Overall, the project was completed successfully. CITT design, the primary objective of the project, was completed and documented from the standpoint of the unit trainer as the CITT "To-Be" 1.0. A prototype CITT in two versions (standalone and distributed) was developed, with the standalone version including greater functionality. The prototype included those functions of CITT design which were feasible during the course of the project. IO development included the production of two videotapes as well as the Learn About CCTT function of the prototype. Evaluation activities occurred throughout the project and included formative evaluation of the prototype. Refinement of the prototype was based on findings of formative evaluation. Approximately forty percent of the findings were able to be included in the refined CITT; the remainder are included in the report as future desired functionalities of CITT. A fielding plan was designed and developed which provides several alternative fielding strategies for the CITT, and lessons learned were documented.

Utilization of Findings:

The specific audiences who will find the information contained in this report beneficial include: (a) designers and developers who continue further development of the CITT, (b) training unit and CCTT training site personnel, (c) simulation system developers, and (d) any member of the U.S. Army who wants to better understand the TSP development process. The primary product of the CITT Project, the CITT design, is fully documented and can be used as the basis for the development of an integrated training tool under any of several fielding alternatives developed as part of the project. In addition, the videotapes and instructional overview could be fielded independently to provide a wide variety of users with information on the CCTT and the use of structured training.

THE COMMANDERS' INTEGRATED TRAINING TOOL FOR THE CLOSE COMBAT
TACTICAL TRAINER: DESIGN, PROTOTYPE DEVELOPMENT, AND LESSONS
LEARNED

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THE COMMANDERS' INTEGRATED TRAINING TOOL FOR THE CLOSE COMBAT TACTICAL TRAINER: DESIGN, PROTOTYPE DEVELOPMENT, AND LESSONS LEARNED

INTRODUCTION

The U.S. Army is currently fielding the Close Combat Tactical Trainer (CCTT)¹ as the first member of the Combined Arms Tactical Trainer (CATT) family. The CCTT provides a virtual environment supporting the collective training of armored and mechanized infantry units including combat support and combat service support elements. To maximize its effectiveness, the CCTT will be fielded as a complete, integrated training system, i.e., in addition to the basic hardware and software that comprise the system, it will also provide the tools required to enable its users to achieve maximum benefit from its use. Several such tools are currently available in various stages of development. One is an interactive courseware product called Education of CCTT through Computer Assisted Training Technology (EDUCCATT) being developed by the Project Manager (PM) for CATT to train unit personnel on the operation of CCTT workstations supporting the execution of training exercises. Another is a set of more than fifty training exercises and training support packages (TSPs) that were developed by the Army Research Institute's Armored Forces Research Unit (ARI AFRU) at Fort Knox, KY, in conjunction with PM CATT and the Training and Doctrine Command (TRADOC) System Manager (TSM) for CATT under the Structured Training for Units in the Close Combat Tactical Trainer (STRUCCTT) (Flynn, Campbell, Myers, & Burnside, 1998) and the follow-on STRUCCTT-2 projects (Deatz, Forrest, Holden, Sawyer, Britt, & Gray, 1998).

As CCTT training tools, techniques, and procedures have evolved, the need has increased for integrating them so that commanders and other unit trainers can access and use them readily and effectively. Such an integrating system or tool should: (a) provide trainers with ready access to all the information and methods they need to exploit the emerging capabilities of CCTT; (b) be compatible with Army training management information systems and databases; (c) lead users to effective and efficient methods for developing and implementing training by providing ready access to available exercises, associated TSPs and other materials; (d) provide users with an understanding of and means to apply a structured approach to meeting training requirements; and (e) address the training of digital forces.

In October, 1997, ARI AFRU initiated a project to address the design and development of a tool having the characteristics described above. That tool is the Commanders' Integrated Training Tool (CITT) for the CCTT. The project involved the design of the CITT as its primary focus and employed standard accepted modeling tools and methods to capture the design from the point of view of commanders and other unit trainers. Secondary goals of the project involved development of an instructional overview (IO) of the CCTT including production of two video tapes, the development of a CITT prototype to demonstrate in concept the feasibility of such a tool for use by unit commanders and other unit trainers, and formative evaluation of the prototype. Throughout the project, the development team collected data on the modeling and development processes and those data appear in this report as the basis for lessons learned.

¹ A list of all acronyms used in this report is included in Appendix A.

Purpose of the Report

The purpose of this report is to describe the research methods and outcomes of the project particularly as related to the primary project objective of designing the CITT. The report will also describe the activities and procedures involved in completing additional project objectives such as IO and prototype development. The report provides an in-depth understanding and description of the methodology and tools used to produce and document the CITT design including a discussion of the differences between the CITT design and the implementation of the design in the CITT prototype. The report describes how the project team was organized and integrated to achieve the project goals, the methods and procedures employed to complete project activities, and the evaluation conducted throughout the project, including quality assurance activities and formative evaluation of the CITT prototype. Team members and other individuals associated with the project contributed the lessons learned. By studying this report, the reader should gain a thorough understanding of the goals of the project, the project's development and evolution, how the team dealt with challenges faced in the project, and how the lessons learned can be applied to similar projects.

Organization of the Report

This report is organized as follows:

1. The Project Background and Need section describes the need for the CITT and the overall purpose of the project including a statement of the project objectives.
2. The Research Methodology section describes the activities that were accomplished to achieve the project objectives organized by major project tasks. It describes the results of the activities including a description of the CITT design, a description of the IO content and development, a description of the development of the CITT prototype in Standalone (CITTSA) and Distributed (CITTDT) versions, and a description of the implementation strategy and fielding plan including recommendations of the project team for fielding the CITT as ultimately envisioned or designed. This includes a description of how the CITT could be integrated into other existing and planned Army training information systems.
3. The Project Evaluation section includes a discussion of the quality assurance/control activities conducted throughout the project and concludes with a description of the formative evaluation of the CITT prototype including the refinements made to the prototype based on the results of formative evaluation.
4. The Lessons Learned section describes findings from the project that are relevant to future design and development efforts.

PROJECT BACKGROUND AND NEED

The need for a CITT has arisen from several related thrusts. First is the need to ensure that the training that units receive in CCTT is matched as closely as possible to their needs, and that it has maximum effectiveness and efficiency. Next is the increasing use of structured training in a virtual environment as a vehicle for training mission essential tasks. Finally, the need exists to provide easy access to other Army training management and database systems such as the Training Module (TRAMOD) Executive Management Information System (TEXMIS) or the Army Doctrine and Training Digital Library (ADTDL) and/or integration into

existing training systems such as the Standard Army Training System (SATS) or the Automated Systems Approach to Training (ASAT).

Training in CCTT

The CCTT is a Distributed Interactive Simulation (DIS) compliant system designed to facilitate the training of collective armor and mechanized infantry tasks at the platoon through battalion task force level. CCTT is composed of armored vehicle manned module simulators as well as Semi-Automated Forces (SAF), Combat Support and Combat Service Support (CSS) workstations, computer networks and protocols, and After-Action Review (AAR) systems. CCTT provides a virtual environment for training that can be used in a variety of ways. According to the Simulation, Training and Instrumentation Command (STRICOM), "CCTT is the first of the Combined Arms Tactical Trainer (CATT) family of virtual trainers. CCTT will train Armor, Cavalry, and Mechanized Infantry platoons through Battalion/Task Force on their doctrinal Mission Training Plan collective tasks." (STRICOM, 1998a)

Figure 1 illustrates the typical CCTT system and functions. Manned modules consist of high fidelity, full-crew replications of the M1A1/M1A2 Abrams Main Battle Tank, the M2A2/M3A2 Bradley Fighting Vehicle, the M113A3 Armored Personnel Carrier (APC), the

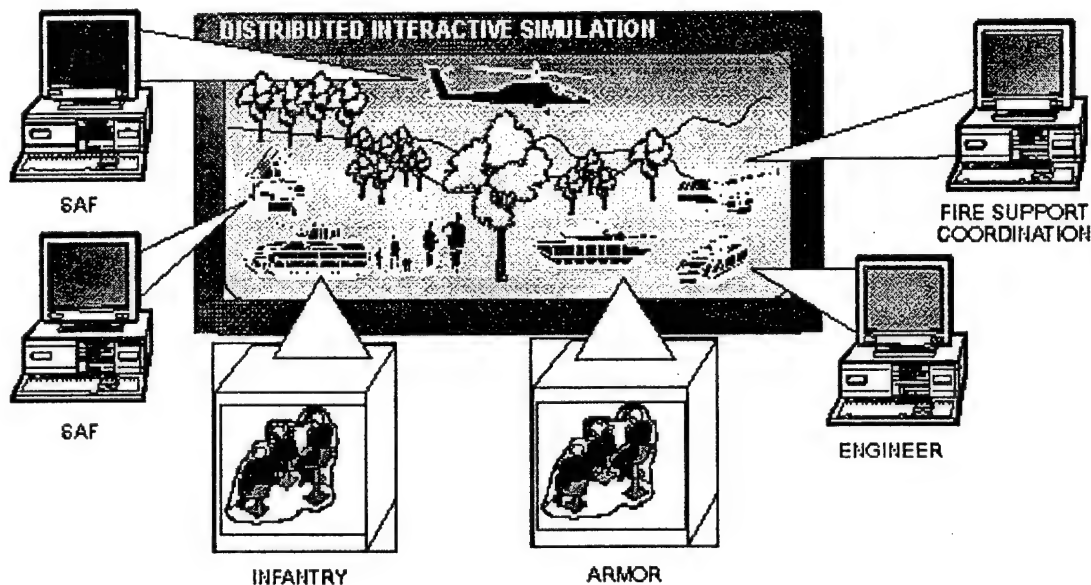


Figure 1. The Close Combat Tactical Trainer.

M981 Fire Support Team Vehicle (FIST-V) and the High Mobility Multipurpose Wheeled Vehicle (HMMWV). Additionally, CCTT includes a manned simulator that allows the command element of dismounted infantry platoons (the Dismounted Infantry Module or DIM) to participate in exercises on the synthetic battlefield. Workstation components include multiple operations center or unit support workstations including the Combat Trains Command Post

(CTCP), Field Artillery Battalion Tactical Operations Center (FABTOC), Combat Engineer Support (CES), Fire Direction Center (FDC), Unit Maintenance Collection Point (UMCP), and Tactical Air Control Party (TACP). Control consoles include the Master Control Console (MCC), Maintenance Console (MC), and the AAR Console. CCTT includes SAF workstations which control the Computer Generated Forces (CGF) subsystem simulating opposing forces (OPFOR) as well as friendly forces (BLUFOR) for a training exercise. Finally, CCTT includes the unit Tactical Operations Center (TOC) and Higher Headquarters (HHQ). CCTT provides a realistic virtual environment in which units train on and perform tasks in order to successfully accomplish their collective missions.

An important feature of the CCTT involves training customization. That is, units can, at least to some degree, determine the training experience they will receive in CCTT. At present, however, the mechanism for customizing involves working directly with CCTT site administrators who have the knowledge and skills necessary to modify training exercises. A tool to provide unit commanders with the information necessary to plan and customize their training will have great benefit.

Structured Training

Structured training is an integral component of the Army's Systems Approach to Training (SAT) as described in TRADOC Regulation 350-70 (U.S. Army Training and Doctrine Command, 1995). Structured training "provides mission-based task-focused exercises for units or staff groups. The exercises are deliberately designed to assure that specific situations and events occur providing appropriate conditions for practicing performance of particular tasks, sub-tasks, or actions" (Bessemer & Myers, 1998).

As summarized by Bessemer and Myers (1998), structured training exercises include a number of key characteristics.

1. Scenario Embedded. Exercises are embedded in a complete mission scenario providing a meaningful context.
2. Execution Focused. Actions required to execute the exercise are emphasized.
3. Mission Segmented. Platoon or company exercises are of limited duration allowing for frequent after action reviews (AARs).
4. Task Driven. Exercise events elicit performance of specific tasks that support the training objectives allowing for observation and evaluation based on specified task standards.
5. Compressed Time. Maximum training is delivered in the available training time.
6. Fully Supported. Training is fully supported by providing unit preparation guidance, detailed event guides, and materials for observer-controllers (O/Cs) and simulator operators who conduct the training. The vehicle for accomplishing this is the Training Support Package (TSP).

7. Standardized Library. TSPs are available to support execution of common tasks in the Mission Essential Task List (METL) for particular units.

Exercises are designed to a set of initial conditions (i.e., mission, enemy, troops, terrain, and time available [METT-T]) to ensure that specific conditions and events occur to reinforce learning and build on prior experience. Structured exercises focus on a small number of critical Army Training and Evaluation Plan – Mission Training Plan (ARTEP-MTP) tasks allowing the unit leader to observe and evaluate performance based on selected task standards. All exercises permit standardized (that is repeatable) implementation of these tasks, task steps, and conditions. Tasks are cued consistently which allows the unit to train and retrain to achieve task proficiency at low cost and without extensive resources.

In addition exercises are designed with increasing levels of difficulty to promote a crawl/walk/run training progression. Unit leaders can execute an exercise under a simple (crawl) condition then graduate the unit to more difficult conditions when the unit masters the exercise tasks by varying the conditions under which the task is performed (e.g., enemy, terrain, and environmental conditions.)

Structured training is implemented through the use of training support packages (TSPs) that include all the materials necessary to organize and conduct training and provide focused feedback. TSPs provide standard unit preparation materials, tactical materials, and exercise control materials and instructions for the O/C and support personnel. The O/C and support personnel use the control materials to direct the exercise, coach the unit during the exercise, and provide focused feedback following the exercise. Training is turn-key. Units schedule the training, receive and use the pre-exercise materials to rehearse, arrive at the training site and execute the mission(s), and receive focused feedback on their performance.

By using a structured approach to training, unit leaders focus on tasks from the unit's METL, identify and correct training deficiencies, reinforce performance of specific tasks, and assess the unit's readiness level. Structured training also allows unit leaders to conduct more frequent after action reviews, so units can discuss the battle while the events and actions are still fresh in their minds.

Structured training exercises and TSPs have been developed under a number of ARI directed projects including the Virtual Training Program (VTP) (Hoffman, Graves, Koger, Flynn, & Sever, 1995), STRUCCTT (Flynn, et. al., 1998), and STRUCCTT-2 (Deatz, et. al., 1998). The initial STRUCCTT projects enhanced the capabilities of the CCTT simulation system by creating structured exercises and TSPs to exploit the CCTT system and training capabilities much as the VTP did for the Simulation Networking (SIMNET) system.

To date, over 60 structured TSPs have been developed for CCTT including a set of 40 initial exercises for tank and mechanized infantry platoons and company teams. More recently, exercises have been developed for heavy cavalry units. Although this may appear to provide a substantial library, when one considers the number of scenarios required to train at each echelon, across each type of unit, for each type of mission, at differing levels of intensity, and with varying environmental and battlefield conditions, the number of possible exercises is practically

limitless. Providing the commander with a tool to customize TSPs is another important function of the CITT.

Wilkinson (in preparation) has recently described the need for such a tool that will allow unit commanders to fully exploit CCTT while, at the same time, fulfilling their responsibilities as unit trainers. "This tool is envisioned to be a system that serves as a repository for and supports the development of structured training scenarios. Such a system must have real-time access to information on the appropriate Mission Training Plans (MTPs), the training system, task trainability codes² and any previously developed structured scenarios. This system must support the modification of existing scenarios as well as the development of new scenarios. This system may also be the mechanism for actually building the data file that inputs exercise startup data into the CCTT system or any other training system."

Wilkinson recognizes a number of important needs that such a system should address:

1. It should assist trainers in selecting exercise scenarios based on the unit's training needs if those exercises exist.
2. It should assist trainers in modifying existing exercises so that they more closely match the unit's training needs.
3. It should assist trainers in creating new exercises, if necessary, that take advantage of and provide all of the benefits of structured training. This should be accomplished without the necessity of the unit commander being a subject matter expert (SME) in developing structured training exercises.
4. It should train the trainers in how to exploit the capabilities of CCTT.
5. It should provide each trainer the same level of information on system capabilities that the CCTT SMEs used to develop the existing library of exercises. This will assist innovative trainers to see opportunities to use CCTT to train desired tasks effectively.

In short, according to Wilkinson (in preparation), "What should be clear...is that one cannot afford a piecemeal approach to TSPs for CCTT or any training system. Units require a total system that permits trainers to fully exploit it..."

On the other hand, full exploitation that provides for customization of exercises could lead to a potential conflict between structured training and customized training. Modifications to a structured training exercise could easily lead to non-structured training. This is particularly true if the modifications occur "on the fly." To safeguard against this, it is extremely important that the training tool described by Wilkinson include the cognitive support (i.e., what is structured training, how is it applied, why is it important, how is it developed, etc.) It is also important that the exercise development process built into the tool lead the user, to the maximum extent possible, to develop structured training.

² Also known as Task Performance Support Codes (TPSC). TPSCs describe the relative capacity of CCTT to support collective training of MTP tasks for all Battlefield Operating Systems (BOSs).

While much is still being learned regarding structured training including how to convey the concepts and principles to a wide audience of potential unit trainers, the design of the tool in the current project relied on the combined years of experience of members of the development team both to identify and define the cognitive component and to ensure that it is built into the TSP development process. In addition, the tool will not be developed to be used "on the fly." Rather, it will be designed to be used as part of a carefully planned, deliberate training process which provides flexibility to the unit trainer while preserving structured training principles.

Army Training Systems

Currently, the U.S. Army Training Support Center (ATSC) is the executive agent for the Army Training Information Management Program (ATIMP). Program activities of ATSC support the vision, goals, and strategic direction of the Department of Army (DA) in accordance with the Army Information Resources Management Program (AR 25-1, 1997a). The program mission is to provide Army-wide focus, guidance, and oversight to the development, integration, and operation of training information systems. The ATIMP provides a management and support infrastructure to enhance the coordination of system, process, and data integration and to preclude the development of unnecessary or redundant training business processes, business rules, and information systems.

The ATIMP systems provide a starting point for commanders and unit trainers to obtain information and plan training events. What is needed is a system capable of "bringing the systems together" to provide an effective and efficient method for developing training materials specifically for the CCTT. This is another important function of the CITT.

PROJECT PURPOSE

The overall purpose of the CITT Project was to design the CITT system to provide unit commanders and other unit trainers with the capability to maximize the effectiveness of their unit training in the CCTT virtual trainer. The CITT design would allow commanders to select existing training exercises that match their unit's needs, and if no such exercises exist, to modify existing exercises or develop new ones. Additional purposes of the project were to provide an IO of CCTT including detailed coverage of the principles of structured training for inclusion in the CITT and to serve as the basis for the development of two videotapes; to develop a prototype of the CITT as a proof of concept and to refine the prototype through formative evaluation; to develop implementation methods and fielding recommendations for the CITT; and to record and document lessons learned for application in similar projects.

These purposes were accomplished through the completion of six research and development tasks:

Task 1: Prepare a comprehensive research and development plan.

Task 2: Design an IO addressing incorporation of CCTT into a training strategy and CCTT training capabilities along with methods for exploiting them.

Task 3: Design a complete CITT incorporating the CCTT instructional overview.

Task 4: Develop a prototype CITT and refine it through formative evaluation.

Task 5: Develop an implementation strategy and fielding plans/methods for the CITT.

Task 6: Document lessons learned during development of the CITT along with recommendations relating to CITT implementation and fielding.

RESEARCH METHODOLOGY

Overview

The objectives and scope of the CITT Project required the members of the project to work efficiently. Because production of the CITT products required personnel with diverse knowledge and skills, and because the project required frequent and open communication among team members, a flat organization was created to accomplish the tasks and produce the deliverables of the CITT research and development effort. Under this organization, all team members reported directly to the Project Leader, and, although the team was organized loosely around the major project activities, the entire team participated in most planning and decision-making activities. The structure of the development team emerged because of the need to integrate the efforts of CCTT and structured training experts along with training development, database, information management, evaluation, and Internet experts through all phases of the project. The flat organization also provided for the effective coordination of the efforts of Human Resources Research Organization (HumRRO), the prime contractor, and its subcontractors, Raytheon Inc., TRW, VIA Internet Studios, and Litton-PRC. Collectively these five organizations formed the CITT Project team.

Beginning in October, 1997, the initial project team assembled, consisting of the project leader, an administrative assistant, a multimedia specialist, a systems specialist, an Army training specialist, a training developer, an instructional technologist, a web site development specialist, and a training systems specialist. In mid-November, the team added a program evaluation specialist, and the full team was completed in January with the addition of a database/management information systems (MIS) specialist. The team remained relatively intact throughout the life of the project. The stability of the team contributed to the accomplishments of the project.

Early in the project, the team made critical decisions regarding the daily operation and interaction of the team based on the need to integrate the members and their diverse backgrounds and areas of expertise. Developers recognized early that the project would require a highly integrated effort to ensure the timely application of team members' expertise. The team was encouraged from the beginning to share information, ideas, and decisions on a daily basis. Team members became resources for each other.

Initially, the team collectively identified a set of requirements for an integrated training tool and used these to focus the research on existing and emerging training information management systems. Simultaneously, the team worked together to complete the CITT Research Program Plan (1997), and when the plan was approved by the Contracting Officer's Representative (COR), individuals were assigned to work on specific tasks. The project focused on Tasks 2 and 3 initially with work on Task 4 to begin when Task 3 was approximately 80

percent complete. As will be described below, this requirement was modified as the project proceeded and work on Task 4 began well before Task 3 was 80 percent complete. Work on Task 5 occurred throughout the project although it was not a major focus until late in the project. Also occurring throughout the project were the quality assurance activities designed to monitor the internal processes used by the team to accomplish its tasks. The results of this process, as well as the collective input of the project team, served as the basis of the lessons learned section of this report. Throughout the project, close coordination occurred between the project team and the COR as well as the PM and TSM CATT representatives.

The remainder of this section provides a detailed description of the research methodology and activities occurring to accomplish each project task.

Task 1: Prepare a Comprehensive Research and Development Plan

Beginning in early October, 1997, the project team developed a comprehensive research and development plan based on the CITT Project Statement of Work (SOW) (Department of the Army, 1997c) and the Technical Response to the SOW. After thoroughly analyzing these products, the team members or groups of team members were assigned to research the detailed objectives and the corresponding project tasks to determine the activities required to complete them. As the team wrote drafts of the various components of the research plan, these were circulated among the team members for review and response. This process enabled rapid completion of a detailed Research Program Plan which was presented to the COR on November 25, 1997.

One major change from the original SOW and the Technical Response to the SOW should be noted in this report. The proposed project schedule added slightly more than two months to the period of performance and resulted in the project ending in early December 1998, instead of October 1998. This extension was needed to allow the team to thoroughly research the capabilities of a number of existing and emerging training information management systems being developed by the Army. The team reasoned that these systems might include certain functions required within the CITT, especially those related to TSP development; and the project team recognized the importance of fully understanding the capabilities of these systems so the CITT could integrate with them where appropriate. Additionally, the team thought it necessary to spend more time than originally allowed developing the CITT prototype since many of the lessons learned during development would apply to a comprehensive CITT design. The COR approved this change at no additional cost to the government.

Task 2: Design an Instructional Overview Addressing Incorporation of CCTT into a Training Strategy and CCTT Training Capabilities Along with Methods for Exploiting Them

Following approval of the Research Program Plan, a subgroup of the project team began work on Task 2. The purpose of the IO was to provide commanders and unit trainers of conventional and digital units (platoon through brigade level) with the tools, techniques, and procedures needed to effectively and efficiently plan and execute CCTT training.

A major project constraint concerned the ways in which the IO content was to be provided to the CIIT audiences. The SOW specified videotape as one medium for presenting content, but at two distinct levels: brigade commander and above, and brigade commander and below. At the same time, the project required the integration of the IO content information into the CIIT prototype. As illustrated in Figure 2, a comprehensive analysis of relevant information was completed to identify the IO content. Information examined included the TSM CATT, PM CATT, and STRICOM Internet sites, the CCTT Interoperability documentation (STRICOM, 1998b), the CCTT Workstation Operators Guide (WOG), reports from the STRUCCTT (Flynn, et. al., 1998) and STRUCCTT-2 (Deatz, et. al., 1998) projects, Field Manuals FM 25-100 (Department of the Army, 1988) and FM 25-101 (Department of the Army, 1990), and interviews with subject matter experts on CCTT and structured training. The results of this analysis served as the basis for the development of two video scripts: "The Senior Leader's Guide to CCTT System and Training Capabilities"³ video for brigade commanders and above, and "The Unit Leader's Guide to Training in the CCTT"⁴ video which provides commanders and unit trainers (platoon through brigade) with an explanation of all phases of CCTT training including how to plan, prepare, execute, provide feedback during AARs, complete post-training reports, and provide follow up training opportunities available in the CCTT. Additionally, it provides a brief introduction to the CIIT. The team designed both videos to complement existing CCTT promotional videos produced by PM CATT.

The IO content also served as the basis for the development of the "Learn About CCTT" module of the CIIT prototype. The "Learn About CCTT" is a computer-based information module in both the CIITSA and CIITDT versions. The instructional overview and Learn About the CCTT module of the CIIT are based on structured training principles and the overview and train-the-trainer materials developed as part of STRUCCTT.

The remainder of the Task 2 coverage describes the methodology for designing and developing the instructional overview videos and prototype content.

³ The Senior Leader's Guide to CCTT System and Training Capabilities video can be obtained from the Training Support Center at your installation by ordering TVT 17-221, PIN 711132.

⁴ The Unit Leader's Guide to Training in the CCTT video can be obtained from the Training Support Center at your installation by ordering TVT 17-220, PIN 711131.

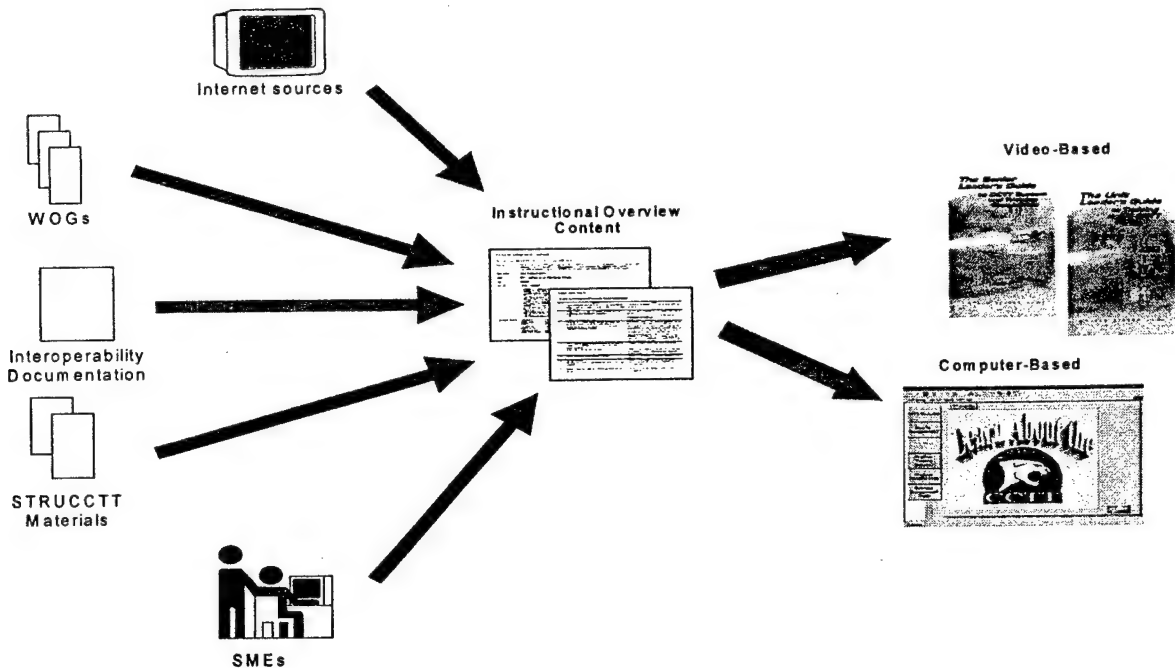


Figure 2. The instructional overview.

Design a Comprehensive Instructional Overview

One of the first tasks completed in the design of the Instructional Overview was to investigate the CCTT system and training capabilities including those available at the Fort Hood, TX, site through 1998. The investigation included a review of CCTT Interoperability Description Document and training information, STRUCCTT overview and unit guidance materials, as well as Workstation Operations Guide (WOG) developed by the PM CATT. It also included information gathered from the Internet starting with the STRICOM, CCTT, and PM CATT Internet information sites. This information was examined and reviewed to determine the overall system and training capabilities of the CCTT, the echelons and exercises supported by the CCTT, how the CCTT supports an annual training strategy, and the possible uses of the CCTT to support various training events and requirements.

The project team examined the experience and lessons learned from the STRUCCTT Projects to exploit CCTT training capabilities, especially the tools, techniques, and procedures for the successful planning, preparation, execution, and assessment of simulation training using a structured training approach. In addition, they incorporated information gained from the CCTT-Digital (Dierksmeier, Wunsch, Liebrecht, Sawyer, Quinkert, & Wilkinson, 1999) research project and the CCTT XXI vision (LTC Jeff Wilkinson, personal communication, May 22, 1998) developed by TSM CATT.

Project team members used their experience and expertise to analyze and synthesize collected information to produce a detailed listing of the content of the instructional overview. After reviewing and researching the CCTT system and training capabilities, the next step was to create detailed outlines highlighting the major points of information to be presented and the

media needed to illustrate that information in the instructional overview. The Team identified the major high-level topics, broke the topics into groups, then subgroups of needed information. The next step was to visualize the text, graphics, audio, and video that would best enhance the meaning or the message of each topic. The team used different themes, i.e., the Army's Nine Principles of Training and "Captain Smith visiting the CCTT Site" to prepare for his scheduled CCTT training rotation, to reflect the interest of the audience, promote the understanding of CCTT tools, techniques, and procedures, and support Army training methodologies. At this point, the team separated video design and computer-based design, at least conceptually, and continued to work on each.

Video-based Design and Development.

As stated previously, two instructional videos were developed: The "Senior Leader's Guide to CCTT System and Training Capabilities" geared towards brigade commanders and above, and the "Unit Leader's Guide to Training in the CCTT" for unit training leaders (platoon through brigade).

The "Senior Leader's Guide to CCTT System and Training Capabilities" includes the following information:

1. How the CCTT system creates a realistic and challenging training environment.
2. How the CCTT builds on the experience gained from the SIMNET system.
3. The terrain databases available in the CCTT system.
4. The types of environmental conditions simulated in the CCTT system.
5. The major components of the CCTT system.
6. The types of manned modules and workstations available for training.
7. The training capabilities of the CCTT system.
8. The locations of the CCTT Fixed and Mobile Sites.
9. How the CCTT can support an annual training strategy to include use of CCTT before or after various training events and requirements.
10. How the CCTT can support training of digital units.
11. The principles, characteristics, and benefits of using a structured approach to training in the CCTT.
12. The components and materials contained in a CCTT training support package.
13. The types of structured exercises available for the CCTT system.
14. The Commanders' Integrated Training Tool and methods for accessing it.

The "Unit Leader's Guide to Training in the CCTT" includes the following information:

1. How the CCTT system creates a realistic and challenging training environment.
2. The terrain databases available in the CCTT system.
3. The types of environmental conditions simulated in the CCTT system.
4. The major components of the CCTT system.
5. The types of manned modules and workstations available for training including combat, combat support, and combat service support elements.
6. The principles, characteristics, and benefits of using a structured approach to training in the CCTT.

7. The components and materials contained in a CCTT training support package.
8. The types of tasks trained in the CCTT.
9. The Commanders' Integrated Training Tool and methods for accessing it.
10. The activities involved in planning for CCTT training including information on how to plan for CCTT training, use the CITT to select the training, review the support requirements, coordinate with the CCTT Site, and the types of supplies and equipment needed.
11. The activities involved in preparing for CCTT training including conducting troop leading procedures, familiarization training, and attending the Site's Initial Briefing.
12. The activities involved in executing a CCTT exercise including the tools, techniques, and procedures for executing a structured training exercise in the CCTT. This also highlights the roles and responsibilities of the training unit, the observer/controller (O/C), and workstation operators.
13. The activities involved in assessing a CCTT exercise including the tools, techniques and procedures for assessing the unit's task performance.

Upon completion of the outlines, the team developed scripts to provide the dialogue (narration) and visuals as well as instructions for producing the instructional overview (e.g., sound effects, timing, camera angles, and lighting). In addition to the scripts, they created storyboards for those scenes having multiple events to illustrate how those events would be included in the video.

Pre-production. Once the design was approved and recommendations incorporated, the project team, with the support of the Fort Knox Television Division, produced the instructional overview videos. One of the advantages of partnering with Television Division was that both videos would be readily available through Army distribution channels. The project team involved Television Division in the earliest stages of design and development to ensure the overview was structurally sound and presented in logical sequence. The project team worked closely with Television Division during the pre-production, production, and post-production phases of the instructional overview.

During the pre-production phase, team members identified the resources and media requirements needed to develop the instructional overview. These requirements specified the most appropriate media for development of the instructional overview including:

1. Video footage.
2. Virtual footage.
3. Text On Screen.
4. Computer Animation Graphics.
5. Tactical Message Traffic.

Preparations began for video production including scheduling the CCTT sites at Fort Knox and Fort Hood, coordination with the STRUCCTT Team to have CCTT electronic files built to capture virtual footage, and discussions with the training unit and O/C scheduled for training at the Fort Knox CCTT site to ensure the intent and context of the video was understood. Computer animation and graphics needed during production were also designed.

Production. Production of the instructional overview videos took place at the Fort Knox and Fort Hood CCTT sites. The project team used the approach to creating resource reels illustrated in Figure 3. Simultaneously narration was produced, graphics were developed or selected, and video clips were developed or selected. These were used to produce the resource reel from which the CITT videos were assembled.

Fort Knox Television Division assisted the team to capture the necessary video and virtual footage. Although a majority of the required video shots were staged, the team decided to capture the interactions of the training unit and the O/C with minimal interruptions to the training process. This complex process included two cameras set up to focus on the O/C at the After Action Review Workstation, two cameras located inside the manned module, and a scan converter employed to obtain virtual footage. All cameras were synchronized to capture interactions simultaneously. While the team obtained the required video footage, graphic artists developed the computer animation and graphics needed to support the instructional overview.

After obtaining the video and virtual footage, the team reviewed the material to select the best visuals to support the concept of the video and the narration. Next, they created the resource reel. For each scene, the team selected video and/or virtual footage and placed it on the resource reel for assembly with the narration. Next, they merged resource reel with the narration and computer animation and graphics, and assembled them onto tape.

Post-production. During post-production, the team mixed sound bits recorded at Fort Knox and Fort Hood with background music and sound effects to achieve the best possible clarity and quality. Building up sound effects one operation at a time, it took many steps to achieve the final result. Once the background music and sound effects were added, they were balanced and combined on a single audio track. When this was completed, work began on the transitions and dissolves between each scene. The final step involved creating the master tape then "dubbing" (copying) the master for distribution.

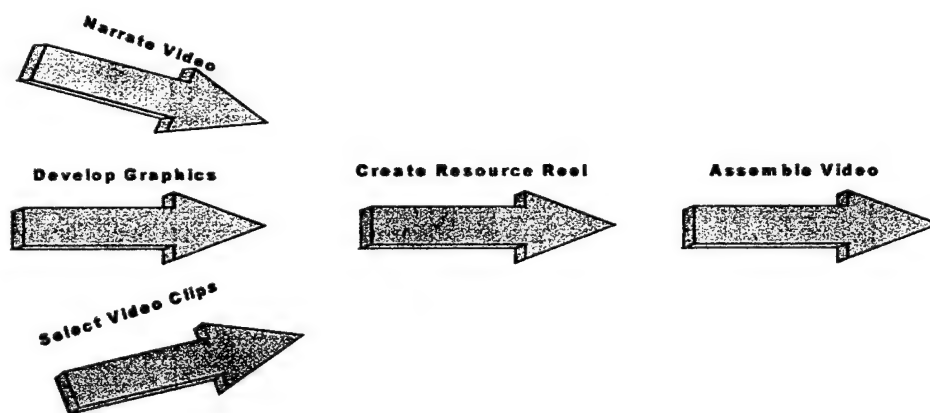


Figure 3. The video creation process.

Computer-based Design and Development

In addition to the video-based instructional overview, an instructional overview for inclusion in the CITTSA and CITTDI was designed. The instructional overview serves two purposes: it provides unit trainers with more detailed information than contained in the instructional overview videos regarding the system and training capabilities of the CCTT and methods for exploiting them; and it provides unit trainers, site staff, workstation operators, and O/Cs with information concerning their roles and responsibilities in planning, preparing, executing and assessing a structured training exercise in the CCTT.

The team analyzed the instructional overview outlines, scripts, and videos to determine the information to include in the computer-based instructional overview. With the CITT prototype design (see Task 4) proceeding, the team determined that this information would comprise the "Learn About the CCTT" module of the CITT prototype for both the CITTSA and CITTDI.

The "Learn About the CCTT" module for CITT system contains the following information topics:

1. Explore the CCTT: An overview of the CCTT system describing the "Train as You Fight" philosophy including a general reference to the units and echelons trained, major components of the CCTT, features of the CCTT, and the standard and mobile site configurations.
2. Examine the CCTT System Capabilities: An overview describing the system capabilities and role of the major components of the CCTT system. It also provides information on how the major components interact to create a realistic virtual battlefield.
3. Examine the CCTT Training Capabilities: An overview describing the training capabilities of the CCTT system including the types of units and echelons that can be supported in the CCTT, additional training possibilities, and how the CCTT supports an annual training strategy.
4. Learn About Structured Training: An overview describing the principles, characteristics, and benefits of using a structured approach to training in the CCTT. It also provides the components and materials contained in a CCTT training support package.
5. Learn About the Training Process: An overview describing the tools, techniques, and procedures for planning, preparing, executing, and assessing a structured exercise in the CCTT.
6. Learn About CCTT Exercises: An overview describing the types of training exercises supported by the CCTT (e.g., Orientation Exercises, Situational Training Exercises, Platoon Gunnery Exercises, Command Field Exercises, and Tactical Exercises Without Troops).

In developing the computer-based instructional overview, the project team considered how the information should be structured for maximum effectiveness when presented via computer, the content layout, and how users might choose to navigate through the information.

Structure. The computer-based instructional overview is designed to provide users with graduated levels of information. High-level information topics (level 1) are identified, broken into groups (level 2), and then into subgroups of information (level 3). Each information topic is systematically structured and labeled so that the user can selectively view or skip individual

topics and/or advance to a topic for which they have an immediate need (see Figure 4). Each topic is composed of one or more pages of information. In addition, each topic has hyperlinks to optional pages containing more detailed information or further explanations related to that topic.

Layout. The layout of the instructional overview represents a balance between form (visual appearance) and function (easy access to information). The team intended to provide a basic layout so that each page had a predictable look and feel. So as not to distract the user, the background color remained neutral. Headers with prominent titles appeared at the top of each page to assist the user in identifying the topic and level of information.

Graphics were used sparingly and only when necessary to assist the user in understanding the content. Graphics were in the form of two-dimensional drawings and digitized Graphic Interchange Format (GIF) images. In addition, the team included demonstrations of performances as embedded videos in the Standalone version to provide users with multimedia examples of structured exercises available in the CCTT.⁵

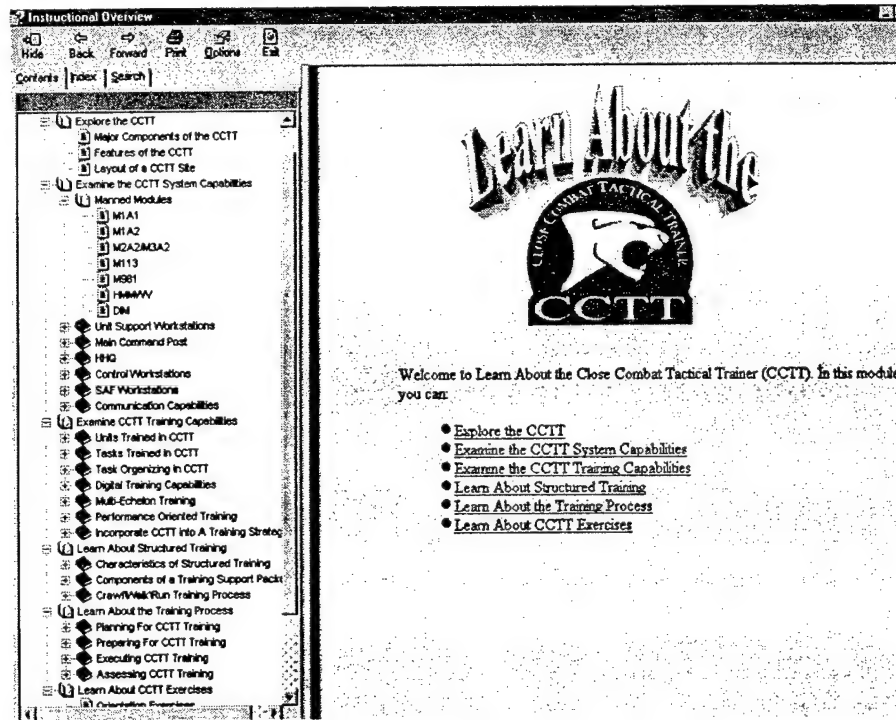


Figure 4. CITT instructional overview structure.

Navigation. Users were given several options for navigating through the instructional overview. First, by using standard buttons on each page the user can move to the "Next" page or return to the "Previous" page in a linear sequence (see Figure 5). Second, the prototype design

⁵ Demonstrations of performance are examples in the form of digital videos which show users how tasks and exercises are performed in the CCTT.

allows for a standard browser, and all browsers provide "Back" and "Forward" buttons that allow the user to move backward and forward through pages they have already viewed. Third, the user can navigate by clicking on the tree diagram shown in the left-hand frame of Figure 4 with each topic serving as a link enabling users to move to any topic, or page within a topic, in a non-linear sequence. Fourth, the topics include numerous embedded hyperlinks (see Figure 5) which provide the user with a "threaded" navigation scheme; i.e., the user can examine content related to a topic by selecting hyperlinks to related information. Finally, the user has available an index and a search feature allowing the user to select or type in a keyword or phase in order to view the desired information.

To summarize, based on the extensive body of information on CCTT, structured training, etc., assembled for Task 2, the team members designed the "Learn About CCTT" component of the CITT to provide the user with all of the information he or she will require to make effective use of training in the CCTT. The team also designed the components to be user friendly and to allow for a variety of user styles. Users can choose among several different methods of navigating through the content, and a variety of instructional modes including text, graphics, and video are used to support learning.

Components of a Training Support Package		
A training support package (TSP) is a complete package of integrated training materials that includes information necessary to efficiently and effectively train ARTEP-MTP tasks.		
A CCTT TSP contains the following components and materials:		
TSP Components	Description	Materials
<u>Selection Materials</u>	These materials assist the unit leader in selecting exercises needed to support the unit's training plan and objectives.	<u>Exercise Thumbnails</u> <u>Exercise Outlines</u>
<u>Tactical Materials</u>	These materials provide the operational context for the exercise.	<u>OPORDs</u> <u>Overlays</u>
<u>Exercise Materials</u>	These materials provide the information and instructions that the unit will need to conduct a structured exercise in the CCTT. It also contains the information and instructions used to conduct the AAR.	Exercise TSP that includes: <u>Event Guides</u> <u>Workstation Execution Guidelines</u> <u>AAR Worksheets</u> <u>Task Charts</u>
<u>Simulation Materials</u>	These materials provide the information the CCTT Site Staff will need to build and proof the exercise file.	<u>Plan Sheets</u> <u>Commo Data</u> <u>Exercise Files</u>

Figure 5. An example of the use of hyperlinks for navigation within the instructional overview. Hyperlinks are underlined words and phrases.

Task 3: Design a Complete CITT Incorporating the CCTT Instructional Overview

This section provides information on the design of the CITT. It includes discussion of the needs assessment activities related to Task 3, the definition of the CITT (hardware and software) requirements, the design and modeling process, and the actual CITT models. The team completed these activities/outcomes within the constraints specified in the SOW indicating that the CITT was to be designed as a fully-integrated training system that attends to the needs of the senior commander, commander, unit trainer, and training analyst as well as the casual user.

Three specific design requirements were identified for the CITT. First, the CITT was to be designed to be an information system. Second, it was to be designed as a fully integrated training tool providing the user with a means to obtain training information from a variety of sources. Finally, it was to be designed to provide the user with information concerning training capabilities and a road map for the successful planning, preparation, execution, and sustainment of training using a structured, simulation-based approach in CCTT.

Throughout the remainder of this document, references to the CITT "system" refer to the hardware, software, and documentation components that were developed in the project and that comprise the CITT. Specific discussion of hardware configurations recommended for the CITT system are clearly delineated within this document, as are those for the application that is demonstrated in the CITT prototype.

Needs Assessment and Requirements Definition

The design of the CITT incorporates the widely accepted principles described in the Methodology for the Development of Structured Simulation-based Training (Campbell, Campbell, Sanders, Flynn, and Myers, 1995) and is intended to support training plans identified by the Force XXI, Warfighter XXI, and Army Training XXI training and campaign plans. The intent of the process was to produce a viable design that would serve as the basis for future development as well as for the development of a "proof-of-concept" prototype. In actuality, two designs were produced: the CITT "To-Be" design which lays out the architecture and data requirements for a system which satisfies all of the requirements in the SOW; and a CITT "As-Is" design which is limited to a description of the architecture and data requirements for the prototype CITT actually built. According to plan, an experienced team of training development, instructional design, and simulation systems subject matter experts, as opposed to software developers, undertook the task of designing the CITT.

Identifying Design Requirements

Within the context of the above, the project team completed an assessment of the CITT system requirements. They envisioned that the CITT would provide the following:

1. An introduction to the CCTT and its capabilities and limitations.
2. An introduction to the CITT and its capabilities and limitations.
3. Access to existing CCTT TSPs.
4. Instructions and tools for the use of these TSPs.
5. Instructions and tools for modifying these TSPs.
6. Instructions and tools for creating new TSPs.

7. Instructions and tools for building exercise files based upon these TSPs.
8. Guidelines for testing or proofing TSPs.
9. Information concerning other uses of CCTT (e.g., gunnery training, Situational Training Exercises (STXs), etc.).
10. Links to previously developed electronic aides and computer-based instruction, such as EDUCCATT and demonstrations of performance.
11. Help files.
12. Detailed listing of Point Of Contacts (POCs) available for CCTT users.

In addition, there was an implied requirement to link to ATIMP Systems (e.g., SATS and ASAT). This link was intended to ensure that information deemed essential to the operation of the tactical unit (e.g., Mission Training Plans, resource listings, and doctrinal publications) was available to the CITT user.

The intent was to design a system that would satisfy these requirements through both a standalone system and from distributed (Internet) access. This is consistent with the essence of the Army Training XXI (AT XXI) Campaign Plan in that it exploits, or directs users to exploit, state-of-the-art technologies in information systems to allow units to better plan, prepare, execute, and manage collective training (Department of the Army, 1997b).

Further, the team envisioned that the CITT would be usable on the personal computers found within a typical Army unit's Orderly or Training Rooms, and also, that users would want to access the CITT from the personal computer found in their homes. The team intended to provide the design for a robust system that would last well into the 21st century.

In responding to these needs, the team envisioned a single design with two primary components, the first of which would be an information repository complete with information concerning:

1. The CITT itself.
2. The CCTT system.
3. Training on the CCTT.
4. The structured simulation-based methodology developed using the SAT Process and developed during five plus years of support to TSP development.

This information repository would be based on the IO content as described above.

The second component would be a fully interactive system allowing the user to review and modify existing TSP materials as well as to create new TSPs in accordance with the structured training methodology previously discussed. The design would also provide links to other information systems that expand upon the basic capabilities of the CITT as described above.

Finally, the team determined that the basic CITT software package had to be a complete application and include commercial-off-the-shelf (COTS) software capabilities and links. This includes word processing, spreadsheets, a graphics package, and a database repository.

Identifying a Design Methodology

In assessing how to design, document, and build an application that satisfies the system requirements, the project team conducted a needs analysis to determine how best to proceed. This analysis revealed two primary concerns. First, the team recognized a need to modify the structured simulation-based methodology described earlier and apply it to a computer-based application. This training development methodology, as identified in the various research and development programs sponsored by ARI, is based upon the Instructional Systems Design (ISD) process. This process has been codified as the SAT process as identified in TRADOC Regulation 350-70 (Department of the Army, 1995) and is considered the Army's training development process. Second, because of the possible integration of the CITT system with other ATIMP Systems, the team determined a need to adhere to Department of Defense (DoD) and Department of the Army (DA) regulations as well as other guidance concerning the design, development, and documentation of such systems. These regulations include DA Pamphlet 25-1 (Army Information Architecture), TRADOC Pamphlet 25-71 (Standards for Electronic Staffing, Publication, and Archiving, Department of the Army, 1997d), MIL-STD-498 (Software Development and Documentation), and the Federal Information Processing Publication 183, Integration Definition for Function Modeling (IDEF) (U. S. Department of Commerce, 1993).

The first concern was answered by adhering to the SAT process. This process establishes a well-defined methodology that is applicable to both training and the design of training tools. The steps included in this process for the design of the CITT system are:

1. An initial design phase that includes an assessment phase to determine requirements, an analysis phase that considers what was learned from the assessment, and a design phase where the results of the analysis serve as a baseline.
2. A development phase intended to produce the design.
3. A formative evaluation phase (for both design and development phases).
4. An implementation phase where recommendations for fielding the developed product are made.

The use of the SAT process required modification by the project team for two reasons. First, the project team was operating on a tight schedule which required shortening some activities. Second, team members were acting as both designer/developers as well as subject matter experts on the original methodology.

The second concern was addressed by the project team's attention to DoD and DA guidance in documenting the design of the CITT application, particularly as related to the potential integration of the CITT application into ATIMP Systems. The team initiated a close investigation of DA policies concerning the design and development of software applications. This investigation identified ATSC, a subordinate command of TRADOC, as the proponent agency. This led to a significant finding concerning software solutions that would facilitate the design process. The project team reviewed the SAT, ASAT, and Combined Arms Training Strategy (CATS) Systems and discovered that all were initially designed and developed using

common business process reengineering applications and tools⁶. To attend to the challenges inherent in enterprise engineering, the DoD and DA have begun to use Integrated Definition modeling.

The Integrated DEFinition (IDEF) methodology is a suite or family of methods that supports the modeling needs of an enterprise and its business areas. IDEF technologies have grown over the past several years and are used widely by both the DoD and some of the largest U.S. corporations. Although IDEF was originally intended for use in systems engineering, the suite of IDEF methods has evolved and contains the necessary notations to support software development. When constructed properly, IDEFØ, IDEF1, IDEF1X, and IDEF3 models can be complementary to software engineering business rules. Their uses are described below (Mayer, Benjamin, Caraway and Painter, 1998):

1. IDEFØ modeling is used to produce a function or activity model that is a structured representation of the functions of the system or environment and of the information and objects that interrelate those functions or activities.
2. IDEF1 modeling is used to produce an information model that represents the structure of information needed to support the functions or activities of the system or environment.
3. IDEF1X modeling is used for designing relational database schema of the system under development.
4. IDEF3 modeling is used to capture descriptions of sequences of activities. The primary goal of IDEF3 is to provide a structured method by which a subject matter expert can express knowledge about the operation of a particular system or organization.

IDEF began when the U. S. Air Force, in response to the identification of the need to improve manufacturing operations, established the Integrated Computer-Aided Manufacturing (ICAM) program in the mid-1970s. A major development from the ICAM program was the Integrated DEFinition methodology. This methodology was to be used as a regimented approach to analyzing an enterprise, capturing "as-is" process models, (i.e., models of the system as it currently exists), and for modeling activities (organizational units) within an enterprise. As noted previously, these methodologies have evolved and contain the necessary notations to support software development and as such are in full use by ATSC⁷.

The Design Process

Design Considerations

The modeling tools identified above created the basic design for the CITT. The key to the initial design of the CITT was in deriving user and system requirements, identifying key

⁶ The term "business process reengineering" has been used primarily in the context of the redesign of industry as it restructures to meet evolving requirements and new industry demands while remaining competitive. This usage has not been employed within the DoD and DA spheres of influence. Within DoD, the accepted term is "enterprise engineering" which represents a structured approach to adapting past practices to new requirements.

⁷ The requirement for using this methodology comes from the DoD Enterprise Model, [Department of Defense, 1993] and has been reinforced by recent guidance from ATSC.

issues and functions/activities as identified earlier in this section, determining interfaces, and allocating architecture requirements to system elements. This involved combining the SAT process and IDEF modeling. The team used an iterative design process completed in two forms to determine requirements. The products of this process included an activity model and a process model. The project team elected to use Commercial-off-the-Shelf (COTS) software, specifically BPwin^{®8} to support all activity modeling and system design. This selection ensured compliance with known ATSC usage as well as facilitated the development of the CITT prototype.

The team used BPwin to detail the model to include all known activities that comprise the overall system design. Outputs from this modeling process include diagrams and activities and form the basis for IDEF modeling. IDEF was useful in establishing the scope of the analysis to determine user needs especially for a functional analysis. As a communication tool, IDEF enhanced subject matter expert involvement through simplified graphical devices. As an analysis tool, IDEF assisted in identifying functions to be performed and activities needed to perform those functions.

The Design Process in Macro Form

The basic IDEF concepts used in the design of the CITT included the following. (Mayer, et al., 1998):

Cell Modeling Graphic Representation. The "box and arrow" graphics of an IDEF diagram show the activity or function as a box and the interfaces to or from the function as arrows entering or leaving the box. These interfaces (the Inputs, Controls, Outputs, and Mechanisms or ICOMs) serve a specific function in helping to describe the model.

1. Inputs represent materials or information transformed or consumed by the activity.
2. Controls represent constraints on the activity with respect to how, when, and/or if an activity is performed. Controls are not transformed as a result of the activity.
3. Outputs represent materials or information that were produced by the activity.
4. Mechanisms represent a person, machine, or other non-consumable resource used to perform the activity.

To express functions, boxes operate simultaneously with other boxes with the interface arrows "constraining" when and how operations are triggered and controlled. A basic model Graphic Representation is depicted in Figure 6.

Communication. IDEF concepts designed to enhance communication included the following:

1. Diagrams based on simple box and arrow graphics with text labels to describe boxes and arrows, and glossary and text to define the precise meanings of diagram elements.
2. The gradual exposition of detail featuring a hierarchical structure with the major functions at the top and with successive levels of sub-functions revealing breakouts of well bounded details.

⁸ BPWin is a registered trademark of PLATINUM Technology, Inc.

3. A "node tree" or "node chart" that provides a quick index for locating details within the hierarchical structure of diagrams. A basic node tree is depicted at Figure 7.
4. The limitation of detail to no more than seven sub-functions on each successive function.

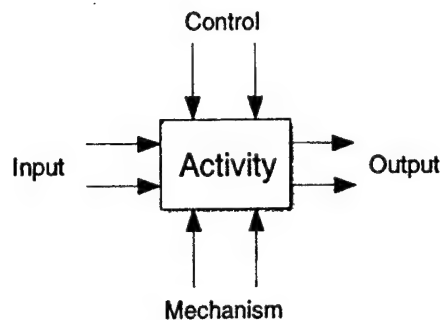


Figure 6. An example of a Graphic Representation.

Rigor and Precision. The rules of IDEFØ require sufficient rigor and precision to satisfy the designers' needs without overly constraining the analysis conducted in the design of any system. As such, IDEFØ rules provide the following:

1. Control of the details communicated at each level (three to seven function boxes at each level of decomposition).
2. Bounded Context (no omissions or additional out-of-scope detail).
3. Diagram Interface Connectivity (Node numbers, Box numbers, chronological creation number or C-number, and Detail Reference Expression).
4. Data Structure Connectivity often referred to as ICOM codes. As described above, ICOM is an acronym for Inputs, Controls, Outputs, and Mechanisms and is best identified as the arrows found in "For-Exposition-Only" (FEO) diagrams.
5. Unique Labels and Titles (no duplicated names).
6. Syntax Rules for Graphics (boxes and arrows).
7. Data Arrow Branch Constraints (labels for constraining the data flow on branches).
8. Input versus Control Separation (a rule for determining the role of data).
9. Data Arrow Label Requirements (minimum labeling rules).
10. Minimum Control of Function (all functions require at least one control).
11. Purpose and Viewpoint (all models have a purpose and viewpoint statement).

Methodology. Step-by-step procedures are provided for modeling, review, and integration tasks.

Organization versus Function. The separation of organization from the function was included by the selection of functions and interface names during the development of the model.

Sequence and Timing Independence. Applying the IDEFØ method resulted in an organized representation of the activities and the important relations between these activities.

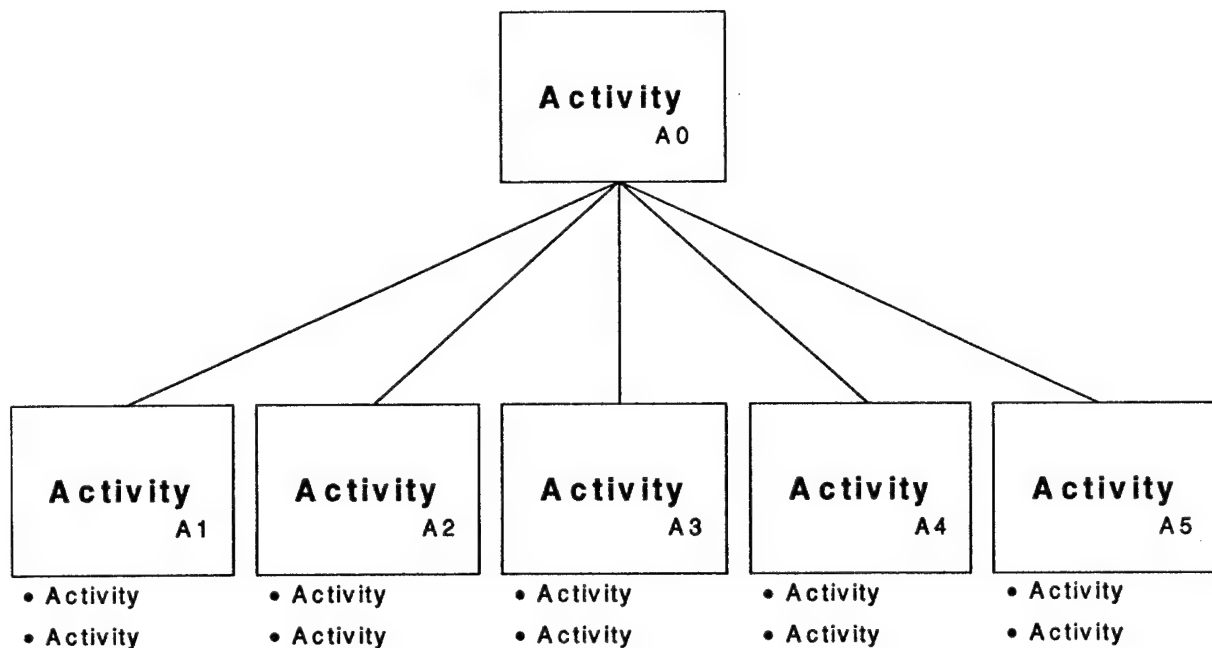


Figure 7. An example of a Node Tree.

Strengths and Weaknesses of IDEFØ Modeling

The primary strength of using IDEFØ modeling was that it proved effective in detailing the CITT activities for the function model. Additionally, the description of the activities of the CITT were easily refined into greater and greater detail until the model proved to be as descriptive as necessary for decision-making. In fact, one of the observed problems with IDEFØ modeling of the CITT was that it was overly concise. In reviewing existing IDEFØ models from ATSC, specifically SATS, ASAT, and CATS, the project team found that these models were so concise that they were understandable only if the reader was an expert in the described system or had participated in the model development. While this initially posed a challenge to the team, a review of those systems helped to clarify design and function questions for the CITT system. This provided the project team with direction in both the selection and use of BPwin.

Once decisions had been made regarding the modeling process and tools that would be used to design and describe the CITT, the actual modeling process began. While modeling was substantially based on the assessment activities that occurred early in the project, of equal importance was the combined subject matter expertise of the project team in structured training principles and concepts and in the operation of the CCTT. Also, since the CITT was an entirely new system, an analytical modeling process had to be developed. That is, because there was no existing system that could be “disassembled” to describe and model it, the team had to model as a sequence of “what if” analyses. They also had to determine from whose viewpoint modeling would occur. The decision was made to model from the viewpoint of the unit commander/unit trainer.

The result of IDEF modeling was a complete exposition of the CITT which met all requirements for IDEFØ modeling and is discussed below under CITT "To-Be" Design. Unfortunately, the model proved to be insufficient in attending to the needs of the prototype developers due in large part to the fact that even though the designers clearly knew the desired functionality for the CITT, the IDEFØ model did not document items that are important in the actual development of a system. Such items include actual graphical user interfaces (GUI) and desired functionality within the model. This produced some difficulties for initial prototype development. When the results of activity modeling were given to the developers, there was a tendency to interpret the model as representing a sequence of activities, and even though the project developers understood that IDEFØ should not be used for modeling activity sequences, it was difficult not to do so. It was natural to order the activities because if one activity's outputs are used as input by another activity, drawing the activity boxes and concept connections is clearer. This tendency became less problematic as modeling and prototype development progressed and the team gained more experience.

A second problem concerned the difficulty the project team had in separating the design of CITT from the development of the CITT prototype. The need to develop a prototype was a given from the start of the project, however, it was stressed that the primary purpose of the project was to design the CITT. Nevertheless, in early modeling sessions, there was significant difficulty separating design from prototype. It was common for design decisions to be confounded by a discussion of whether or not the prototype could be made to work as the design was specifying. This was further confounded by considerations based on the specific software that had been selected for prototype development.

The project team solved these difficulties by adopting a strict working process for modeling which specified that in the initial design and modeling of an activity, no discussion was allowed regarding how that activity would be implemented in the prototype. Only when modeling for an activity was completed was the discussion opened to implementation. This meant that activities were modeled and approved prior to discussions with the project team's developers. Once completed, the designers briefed their model to the project team at which point developers and subject matter experts for training, military operations, and the ISD/SAT process began to determine their individual requirements in light of the approved design. Designers, developers, and SMEs were kept on track by an active project team management that acted as both a clearinghouse and arbitrator of contentious issues. Additionally, this assisted the project team in clearly differentiating between design and prototypical application requirements and the development of logical and physical models that attended to these requirements. Because of this adjustment, modeling proceeded much more efficiently.

The CITT Design

As could be anticipated when using an analytical design process, modeling occurred hierarchically. That is, the team started with top-level activities and proceeded to decompose them into their lower-level activities using the revised modeling process just described. This logical decomposition process continued until the desired level of detail was achieved. The result was the CITT "To-Be" model (i.e., the design of the CITT as specified in the SOW independent of how that design would be implemented in prototype). As modeling and

prototype development proceeded, an "As-Is" model was also documented which illustrates the CITT prototype. The remainder of this section will describe the "To-Be" and "As-Is" models.

The CITT "To-Be" Design

The diagram shown in Figure 8, CITT – Context Diagram, depicts the top-most level of the "To-Be" design of the CITT. This diagram establishes the general bounds of the CITT model. It also represents the boundary of the process with respect to purpose, scope, and viewpoint. Thus, none of the decompositions (or children) of this parent diagram may include factors not considered in it. As the activity is further decomposed and component functions identified, the result is a series of For Exposition Only (FEO) diagrams that depict the design.

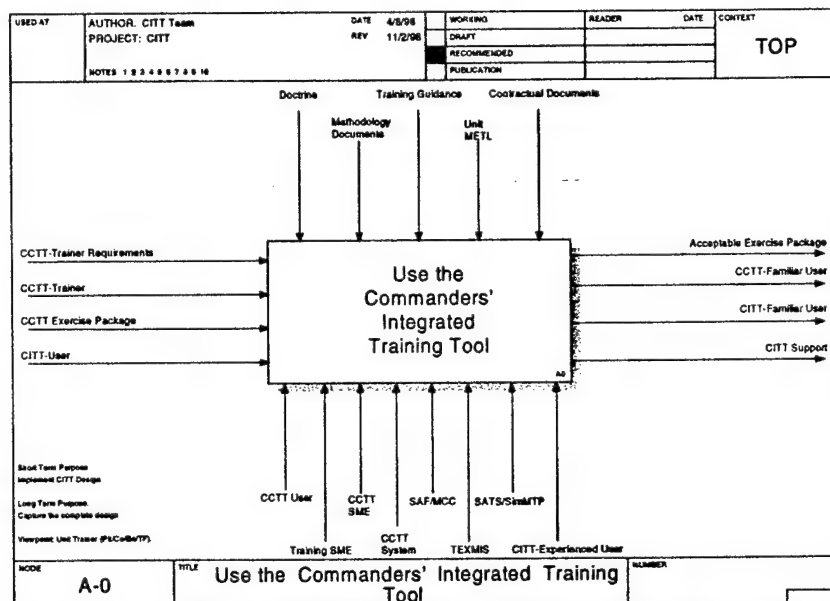


Figure 8. CITT – Context Diagram.

The diagram shown in Figure 9, CITT – Design Top-Level FEO, is the first of the FEO diagrams that resulted from modeling. A FEO is defined as a diagram that depicts two or more sub-processes of an associated parent activity. It is also referred to as a child diagram. Figure 9 depicts the first level of activities decomposed from the top-level diagram in Figure 8. It establishes the major activities or functions envisioned for the CITT. Note also that although it is graphically more complex than its parent, its boundaries remain consistent with those established by the Context Diagram consistent with the definition of an ICOM Graphic Representation as shown in Figure 6.

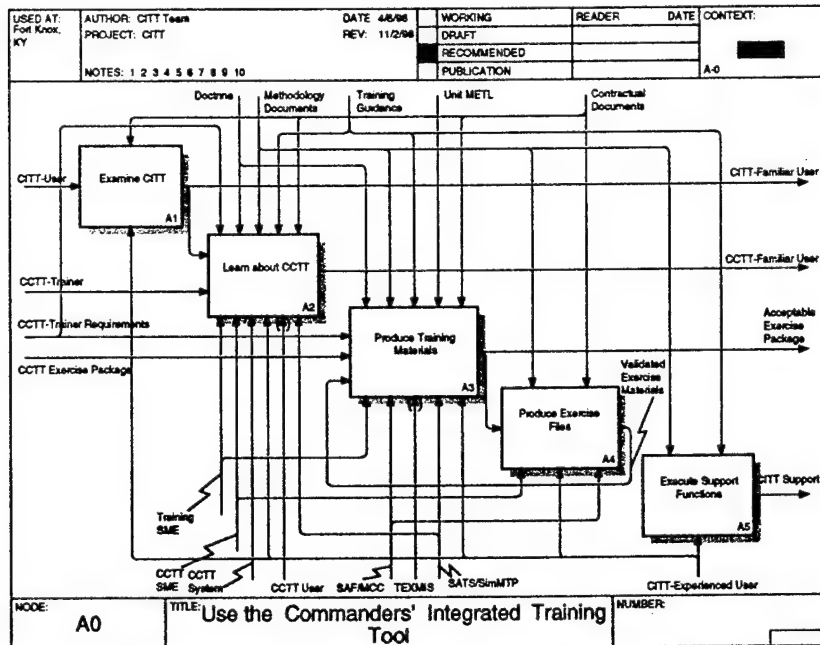


Figure 9. CITT – Design Top-Level FEO.

The graphical representation of the Context Diagram and all of its associated children provides a detailed design of the CITT system. For the “To-Be” CITT, the total number of FEOs is approximately forty. The complete diagrammatic representation of the “To-Be” CITT is contained in CITT Design (To-Be) Documentation (CITT Team, 1998a).

For ease in detailing the CITT “To-Be” model, a series of node tree diagrams was developed to facilitate quick navigation through the CITT “To-Be.” These were completed for the project team as well as for individuals who may not be familiar with the various FEOs that are the CITT design. The diagram shown in Figure 10 is a sample node tree for the top-level and clearly identifies all functions or activities contemplated through three levels of decomposition. To assist the reader in understanding the CITT design, all of the node tree diagrams are included in Appendix B.

To further elucidate the design, the project team employed a feature of BPwin that converts the FEO diagrams into text entries that are dynamically linked to the object-oriented model. These text entries are referred to as Activity Listings, and they provide descriptive information of the activity: definitions, inputs, controls, outputs, mechanisms, and off-page and external references. The project team used this simplified process with great success in detailing the design of the CITT to approving authorities. When used in conjunction with the design diagrams, these documents provide a total description of the CITT system. The “To-Be” Activity Listings are also included in CITT Design (To-Be) Documentation (CITT Team, 1998a).

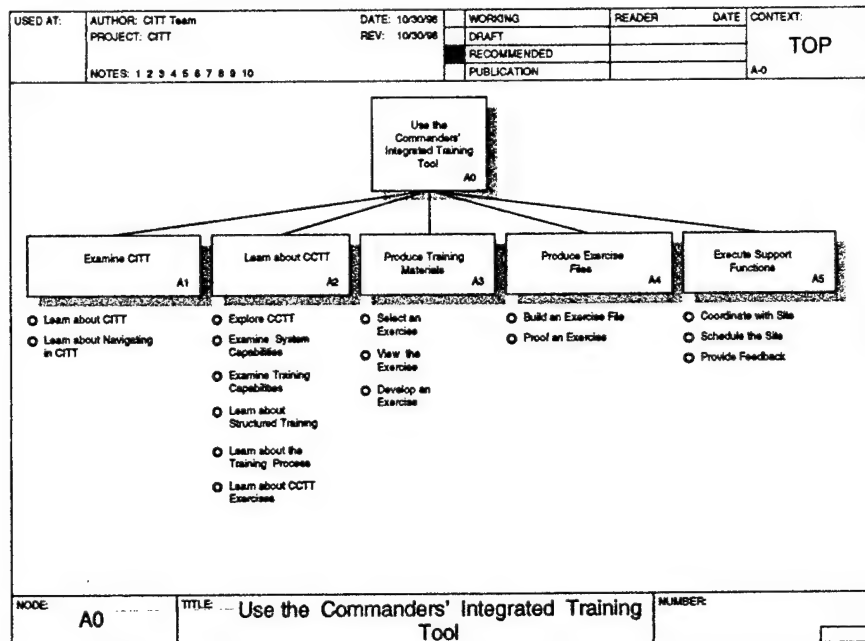


Figure 10. The "To-Be" node tree diagram.

The "To-Be" CITT is a five-node system. For ease of navigation, a Node Tree diagram is included in CITT Design (To-Be) Documentation (CITT Team, 1998a). CITT is designed to provide information to the user concerning both the CITT and CCTT. Additionally, the CITT provides a simple, yet powerful authoring tool for the CCTT user to review and develop exercises designed specifically for the CCTT. The major components of the CITT Design are:

Examine CITT. This component provides information concerning CITT, its intended use, development, capabilities, and limitations as well as detailed guidance on navigation options for the user. It includes warnings concerning the difficulty of Modify and Create activities.

Learn about CCTT. This component includes information concerning CCTT, its innovative uses, development, capabilities, and limitations. It includes up-to-date CCTT system-specific information in graduated levels (to attend to the needs of casual & specialized users) as well as information concerning how to train using CCTT based upon task-based, structured methodology. It includes live links to existing computer-based training (CBT) systems such as EDUCCATT and the Demonstrations of Performance as well as future CBT systems.

Produce Training Materials. This component includes a "how to" prepare and use structured TSPs based upon the structured, simulation-based methodology. It provides information for reviewing the structured training exercises within CCTT, and how to select, modify, or create a CCTT exercise. This is the most complex component of the system and includes links to sources of information concerning weapons systems, doctrine, and tactics as well as to all archived exercises developed in and subsequent to the initial STRUCCTT and STRUCCTT-2 efforts. Additionally, it includes an electronic rendering of the terrain databases upon which users will conduct their exercises once in the CCTT. This rendering is expected to

be as accurate as the plan view displays found in the CCTT and will include the capability to "wargame" an exercise even before it is loaded into the CCTT. Finally, this component includes extensive tutorial/help features based upon lessons learned by various contract teams since the inception of the Virtual Training Program.

Produce Exercise Files. This component provides the means by which the user can modify or create a CCTT exercise file based upon materials identified or developed in the Produce Training Materials section. It includes links to documents created in the previous section, such as Exercise Plansheets, Event Guides, Graphic Control Measure (GCM) data, and Executable Overlay(s) data for an exercise. In the most advanced design form, it is envisioned that this capability will allow for the direct import of exercise data, via standardized data tables, to the CCTT system. Transmission will be accomplished either electronically (e.g., file transfer protocol) or via 3.5" disk or tape archive. It includes a tutorial/help feature.

Execute Support Functions. This component provides information and general "housekeeping" functions internal to the application. It includes the actual links to other source material identified above and is considered a portion of the system itself. It includes a tutorial/help feature.

While general in nature, the descriptions above provide an overview of the CITT design which was the primary objective of this project. When the complete CITT design as contained in CITT Design (To-Be) Documentation (CITT Team, 1998a) is examined, its detail is sufficient enough to allow the experienced application developer working with the designer to develop a robust system that attends to all design parameters. In many cases, the design may actually be more complete than required by the developer. If an electronic version of the model is available, such as is the case in BPwin, the basic design can be imported into a relational database design system (such as ERwin^{®9}) for actual development.

The CITT "As-Is" Design

The diagram represented in Figure 11, CITT – Prototype Context Diagram, depicts the "As-Is" version of the CITT. The "As-Is" design is very similar to the "To-Be" design, as would be expected, however, it reflects only those functionalities actually built into the prototype. This diagram is the highest level for the "As-Is" model. It should be noted that the CITT design effort for the prototype was conducted nearly concurrently with that of the projected design or "To-Be" model. Note also that the general bounds for the model remain similar to those identified in the "To-Be" model. No attempt is being made to compare the "As-Is" to the "To-Be" model; rather, the "As-Is" model is presented for completeness and in keeping with standard industry modeling practices.

The diagram shown in Figure 12, CITT – Prototype Top-Level FEO, is the initial FEO for the "As-Is" model. Note that it differs from Figure 9, CITT – Design Top-Level FEO, in the number of major modules found within the general model. This reflects the moment in time when the prototype model was "frozen" while the development of the design version continued.

⁹ ERwin is a registered trademark of PLATINUM Technology, Inc.

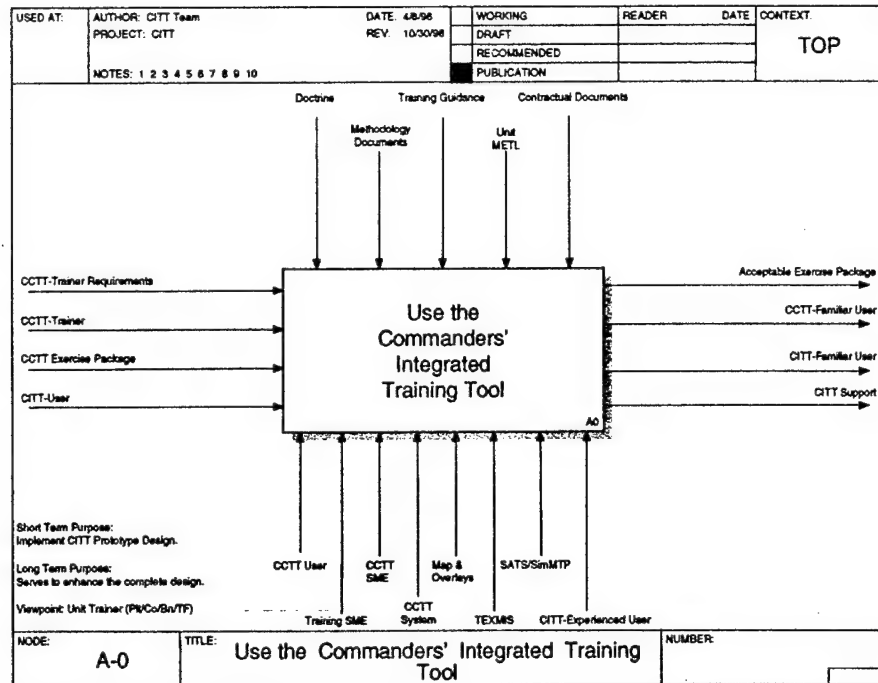


Figure 11. CITT – Prototype Context Diagram.

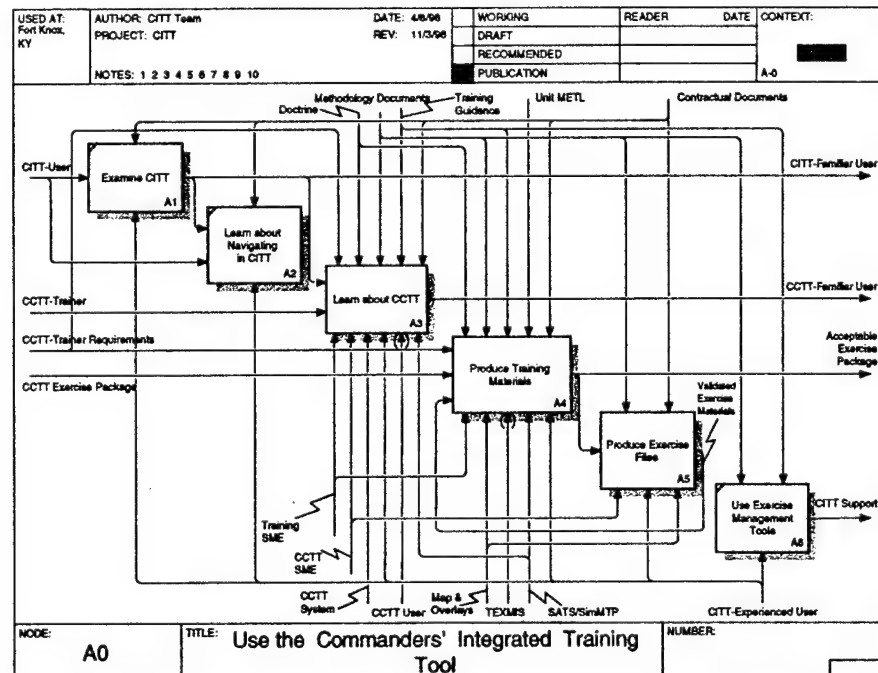


Figure 12. CITT – Prototype Top-Level FEO.

The CITT model for the prototype as well as a Node Tree diagram are included in the CITT Prototype (As-Is) Documentation (CITT Team, 1998b.) The major components of the CITT prototype design are:

Examine CITT. This component includes information concerning CITT, its intended use, development, capabilities, and limitations for the user. It includes general information about the system. It includes warnings concerning the difficulty of Modify and Create activities.

How to Navigate CITT. This component provides information concerning navigating the CITT system by role (e.g., as a unit trainer, participant in training, etc.) or by needs (e.g., to obtain a specific piece of information concerning a specific function).

Learn about CCTT. This component includes information concerning CCTT, its innovative uses, development, capabilities, and limitations. It includes known CCTT system-specific information in graduated levels (to attend to the needs of casual and specialized users) as well as information concerning how to train using CCTT based upon task-based, structured methodology. It includes information concerning other computer-based training (CBT) systems such as EDUCCATT and the Demonstrations of Performance and directs the user to systems where these resources can be accessed.

Produce Training Materials. This component includes a "how to" prepare and use structured TSPs based upon the structured, simulation-based methodology. It provides information for reviewing the structured training exercises within CCTT, and how to select, modify, or create a CCTT exercise. This is the most complex section of the system. It includes information concerning weapons systems, doctrine, and tactics and where this information can be found. It also provides access to exercises developed under government contract that were available at the initiation of the CITT effort. Additionally, users receive an electronic rendering of the terrain database upon which they will conduct their exercise once in the CCTT. This rendering is nearly as accurate as the plan view displays found in the CCTT. It includes extensive tutorial/help based upon lessons learned by various contract teams since the inception of the Virtual Training Program.

Produce Exercise Files. This component provides the means by which the user can learn how a typical CCTT site modifies or creates a CCTT exercise file based upon materials identified or developed in the Produce Training Materials section.

Exercise Management Tools. This component provides a "quick look-up" capability that allows users to check on the status of an exercise file that they may have authored. It is used in conjunction with the "View" and "Modify" options found under the Produce Training Materials component

Execute Support Functions. This component provides information and general "housekeeping" functions internal to the application. It includes existing hyperlinks and other navigational aids that are found within the prototypical CITT and is considered a portion of the system itself. It includes a tutorial/help feature.

As with the "To-Be" application, the team developed a series of node tree diagrams for the "As-Is" application to facilitate quick navigation through the CITT prototype. Again, these

were completed for the project team as well as for those not necessarily familiar with the various FEOs that are the CITT design. The diagram shown in Figure 13 is a sample node tree for the top-level and clearly identifies all functions or activities contemplated through three levels of decomposition.

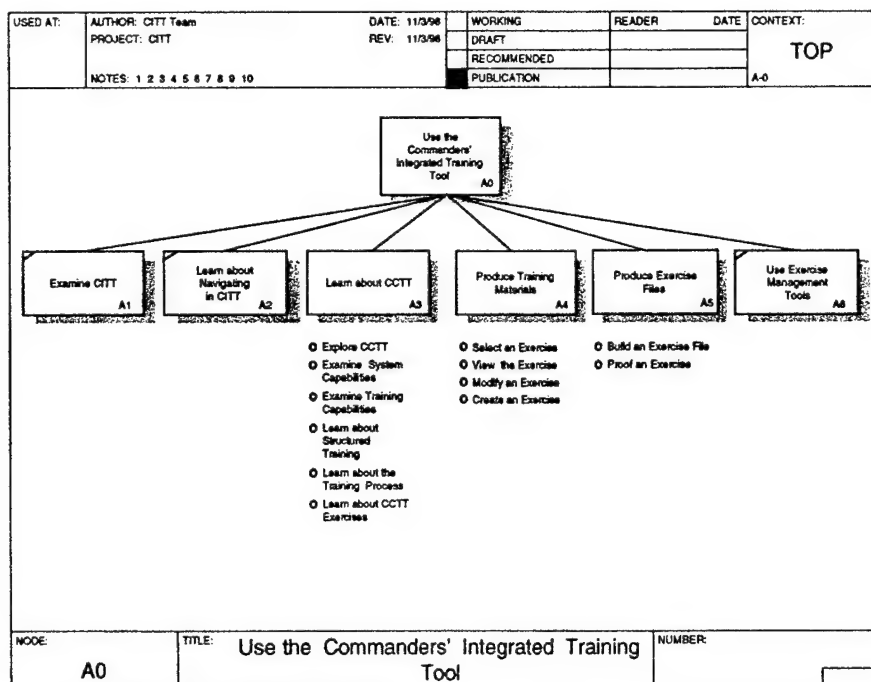


Figure 13. The "As-Is" node tree diagram.

When the descriptions above are compared with those of the "To-Be" model (Figure 10), a striking similarity can be noted. This is because the "As-Is" model is simply a lesser version of the "To-Be" model. Because the project team had the luxury of designing for both "To-Be" and "As-Is" simultaneously, this was a conscious design decision. Simply stated, the "As-Is" CITT is a simplified rendering of the design presented in the "To-Be" CITT based upon that portion of the "To-Be" design that was achievable in the CITT prototype.

The final step required in the design of the CITT system prototype was the specification of hardware and software requirements. In reviewing this requirement, the project team attempted to use both industry and emerging standards to identify an appropriate hardware suite for each prototype. An implied task was to identify a target system that met requirements identified by ATSC for use with evolving ATIMP Systems (e.g., SAT, ASAT, and CATS). The only solution appeared to be that which the United States Military Academy at West Point uses as its common "desktop" for Corps of Cadet members. Colloquially referred to as the "West Point Standard," this solution, identified in Table 1, provides for longevity as well as affordability. It is important to note that although these solutions (identical except for the Internet access requirement) are considered "low-end" systems by current industry standards, they exceed the current capabilities of most systems found in Directorate of Information Management (DOIM) fielded sites. However, these systems can be obtained by DOIMs or their authorized representatives at minimal cost—currently less than \$2000 per system.

Table 1. Prototype Hardware/Software Specifications.

Hardware	Standalone Prototype	Distributed Prototype
Chip Set	Pentium 233	Pentium 233
Random Access Memory	64 Megabyte	64 Megabyte
Hard Drive	2 Gigabyte	2 Gigabyte
Compact Disk-Read Only Memory	Multimedia PC Computing Specification 3	Multimedia PC Computing Specification 3
Video Card	Video Graphics Adapter Card with 4 Megabyte Video Random Access Memory	Video Graphics Adapter Card with 4 Megabyte Video Random Access Memory
Sound Card	Sound Blaster Compatible with Speakers	Sound Blaster Compatible with Speakers
Modem	Not applicable	28.8 Kilobits per second
Screen Display	17" Monitor, 800 x 600 resolution	17" Monitor, 800 x 600 resolution
Printer Driver	Hewlett-Packard Laser Jet 4L Driver	Hewlett-Packard Laser Jet 4L Driver
Operating System	NT Workstation 4.0 w/ Service Pack 3	NT Workstation 4.0 w/ Service Pack 3
Browser	Customized CITT Browser	Microsoft Internet Explorer 4.01
Other Applications	Microsoft Office 97 Professional	Microsoft Office 97 Professional

Task 4: Develop a Prototype CITT and Refine it Through Formative Evaluation

The SOW specified the development and evaluation of a prototype CITT in standalone and distributed (World Wide Web) versions. The prototype was to include: complete development of the instructional overview as both a standalone (videotape) and as an introductory component of the CITT; information needed on the execution of structured training with the CCTT; and links (at least conceptual) to existing bodies of information (such as EDUCATT) that need to be accessed from the CITT. The prototype CITT was to provide commanders and other unit trainers with the capabilities to select, modify, and develop CCTT exercises for platoons and company teams, to access, modify, develop and print required training support materials, and to execute fully the exercises selected, modified, or developed. A formative evaluation of the prototype CITT was to be conducted by monitoring its use by commanders and other unit trainers. This section of the report describes the development of the prototype CITT. Formative evaluation will be described later under project evaluation.

For additional information on the development and structure of the CITTSA, see the System Administrator's Manual for the CITT Prototype (Standalone Version) (CITT Team, 1998e) and the Programmer's Manual for the CITT Prototype (Standalone Version) (CITT Team, 1998c). For additional information on the development and structure of the CITTDT, see the System Administrator & Programmer's Manual for the CITT Prototype (Distributed Version). (CITT Team, 1998d).

Prior to describing Task 4, a clarifying note is in order. Although this report separates the tasks as if they are independent, there was a great deal of overlap between Tasks 3 and 4 which had been anticipated. As modeling was occurring, particularly for the "As-Is" model, the development of the prototype was being done simultaneously. Discussion was occurring and decisions were being made that impacted both design and prototype all within the context of the same work session. Thus, while the two tasks can be separated conceptually, the reader should bear in mind that in design and prototype development, there was often little or no separation, at least in the early phases of Task 4.

Development Approach

Prototype development began with requirements identification in which the project team collected and analyzed data on the prototype CITT functions and activities as they would be implemented in an actual working system. While the functions and activities the CITT prototype would perform were being identified primarily from the design activities occurring in Task 3, the team still needed to determine how these could best be presented to the CITT user. To satisfy this need, a User Jury consisting of a group of key end users representative of the CITT user population was identified and was used in making a number of design decisions. The purpose of the jury was, as McConnell (1998) states, for the project team to "ask the users what they want, show them what they intend to build, and ask them how they like it—then listen carefully until they fully understand both the stated and unstated elements of the users' responses." The jury proved very important in assisting the development team at this stage of the prototype development; as will be discussed below, they also proved very valuable in the evaluation of the prototype.

Shortly after work on Task 4 began, the team built a User Interface Prototype (UIP). A UIP consists of proposed mock-ups of screens for the software system under development that is created for the purpose of eliciting user feedback about the software's intended functionality and look and feel. The team employed various alternatives for displaying and using CITT functions in building the UIP. Initially, the User Jury saw a Simple UIP (SUIP), and the team sought their feedback. The User Jury evaluated the SUIP and provided input regarding the alternatives they were shown. The SUIP was revised until the jury was comfortable with it. The project team developed a User Interface Style Guide (UISG) to codify the UIP's requirements, and all further prototype development was consistent with the UIP.

The project team continued to collect requirements data from Task 3, and, with interface requirements determined, was ready to begin development of operational versions of the CITT prototype. (Although the Research Program Plan had specified that prototype development would begin when design was 80% complete, development actually began much earlier.) The team began to identify critical functions and capabilities and to define the sequence of tasks that end-users were expected to complete using the CITT. At this point, the team specified preliminary database requirements and preliminary database designs.

Next, the team developed a software architecture description in which the CITT was partitioned into major subsystems, interactions among subsystems were specified, and plans to produce them were constructed. At this point prototype versions began to emerge, and the team developed architecture considerations for both, deciding that the actual software for both

versions would be developed in staged builds. Builds are small incremental product development steps aimed at producing running code as soon as possible (Zimmerman, 1997). More precisely, McConnell (1998) identifies a build as a specific instance of a software program at a particular time during its development. Since actual development depends on stable requirements, breaking a software project into builds allows developers to code one build and incorporate changes into the next or a later build. Each build supports succeeding builds and/or improves requirement knowledge. Within the staged builds of the various CITT software components, the project team constructed several incremental builds to arrive at the CITTSA and CITTDT versions that were eventually tested.

The first step in each staged build was documenting the objectives and goals for that particular build and identification of which new functions or capabilities would be included in the build. While planning subsequent builds, the team considered significant problems (bugs) or defects identified in previous builds, however, they found that it was not always possible to address all existing problems in the succeeding build, so some issues were deferred until the final build. With the requirements for a build identified, the next task was to design, code, and test the build. Wherever possible, software was developed and tested in modules (smaller subsets of functional code), then integrated and carefully tested. Specific details on the development of each prototype version are covered next.

CITT Standalone

Database application development

The life cycle development for the CITTSA database application consisted of four structured builds with construction in Microsoft^{®10} Access 97 and mainly addressed the Produce Training Materials activity of the CITT model. Build 0 focused on design and paper-based drafts of tables, relationships, and application forms needed before beginning physical construction of the application. It also included partitioning application activities over the subsequent three builds. Build 1 focused on construction and population of data tables and fields, development of forms for the Select an Exercise and View an Exercise activities, and design and construction of forms for the Modify an Exercise activity. Build 2 marked the first effort of error correction and continued the application development with implementation of code enhancements in the Select, Review and Modify modules, construction of the Create an Exercise module, development of reports, population of all data required in CITTSA, and integration of utility features. Build 3 was primarily intended to be an error correction build but was also used for the addition of utility features and developing forms for the instruction-oriented activities outlined in the CITT dynamic data exchange (DDE) document. Development progressed at a reasonable pace following the delivery strategy as intended, and Builds 1 - 3 concluded with a CITTSA version released for evaluation.

Build 0. The planning activities that comprised Build 0 were critical to ensuring application functionality and were organized to coincide with the progression of activity modeling. During the activity modeling process, STRUCCTT-2 exercises were analyzed, broken into data entities (tables) and attributes (fields), and a draft database table and relationship

¹⁰ Microsoft is a registered trademark of Microsoft Corporation.

structure were designed. Using analyses performed during activity modeling and application of first-through-fourth normal form rules, the team refined the draft structure of the CITT database. (For a discussion of normal form rules as used to test the structure and integrity of data models, see Reingruber and Gregory, 1994.) Initial sketches of user interface forms that included fields and controls were drawn for each activity in the Select an Exercise, View an Exercise, and Modify an Exercise activities. First draft forms were built in a Build 0 database for the main menu which addressed the Use the Commanders' Integrated Training Tool activity, and for each of the modules directly below that activity: Navigate CITT, Learn About CCTT, Produce Training Materials, Produce Exercise Files, and Execute Support Functions. Build 0 ended with a lock placed on the activities that the CITTSA would perform with the exception of Create an Exercise that would be modeled at the end of Build 1.

Build 1. Build 1 tested the materials drafted in Build 0 and initiated application development by addressing three activities: Select, Review and Modify which are included in the Produce Training Materials module (See Figure 14). The data storage tables¹¹ for the application were built in a Build 1 database, and relationships were created between tables to handle data integrity. The team applied data from two exercise TSPs into the tables to verify data storage capabilities. Next, they evaluated data retrieval and update capabilities by developing the Event Guide and Workstation Operator Guidelines forms in the Modify an Exercise activity. During this effort, an Access 97 limitation disallowing more than two levels of embedded sub-forms forced the redesign of components on both forms.

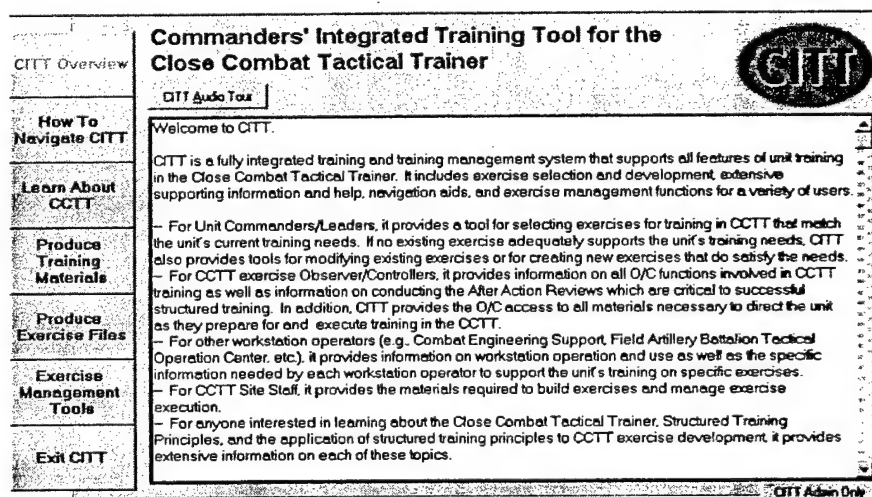


Figure 14. The CITTSA Main Menu screen.

¹¹ A table can be conceptualized as a row x column matrix where the columns represent data elements and the rows represent specific records. The final CITTSA included 38 tables.

The team developed the Modify Training Objectives form with wizard functionality which includes a graphic map or tab navigation and tab-specific assistant help (See Figure 15). The remaining components of modify were constructed and sequenced with previous and next buttons to open and close forms as the user proceeds through the module.

Task Number	Task Name
17.3.2601	CONDUCT RESUPPLY OPERATIONS
17.3.1816	CONDUCT TACTICAL MOVEMENT
17.3.2602	CONDUCT DELIBERATE COORDINATION OF A PLATFORM/AT
17.3.04RLS	REACT TO AIR ATTACK
44.3.0901	CONDUCT PASSIVE AIR DEFENSE MEASURES

Figure 15. The CITTSA Modify Training Objectives screen.

The project team designed the Select an Exercise forms to allow the user to locate an exercise by name, by echelon and unit, by mission, or by up to five ARTEP - MTP tasks specific to the user's echelon and unit. After building these forms with the inclusion of selection by author code or selection by type of exercise on the Select by Name form, the development then focused on the forms required to review an exercise. This process involved creating a form for each section of the exercise and reusing the Event Guide and Workstation Operator Guidelines forms and many of the sub-forms developed for modify so that error correction and design enhancements would involve only one source form. The entire collection of review forms was appended at the end of the modify module with full editing capabilities so that the user could edit an exercise based on the designed CITT methodology or at his discretion.

The final effort in Build 1 was writing the code necessary to copy all the records associated with an exercise. This was a particularly complex coding effort since each exercise spans fifteen tables, fourteen of which contain multiple data records for each record in a parent table. Build 1 was completed with a release of the Build 1 application for testing by the CITT team, production of screen shots for User Jury review, and completion of the modeling and design activities for the Create an Exercise module.

Build 2. Development efforts in Build 2 alternated between a) production of functionality for required modules, b) addition of features requested by team members, the CITT User Jury, or government representatives, and c) correction of errors uncovered during testing by the project team. The final module developed in CITT was the Create an Exercise component.

This included a wizard for the creation of a set of exercises, the code necessary to create as many copies of the template exercise TSP as the user required, design of new forms for Create, and reusing of the modify module forms to ensure consistency. The team constructed reports to print or preview all exercise materials, developed a menu bar and toolbar, integrated identifiers for help topics into all forms, and created the CITT agent to provide audio and text information with animation. With the user interfaces functioning, the team populated the database with the remaining STRUCCTT exercise TSPs, and filled the lookup tables with data for Mission Training Plan (MTP) tasks, task steps and SAF workstation combat instruction sets (CISs). After correcting known bugs, the team released the Build 2 database for informal user testing.

Build 3. The initial timeline for CITTSA application development reserved Build 3 for integration, testing and debugging. Errors found during testing consisted of users unable to add items to forms based on queries; records remaining in the tables after related but not linked data were deleted; and a variety of correctable functionality and presentation errors. Errors were recorded in the Census 97¹² defect tracking software and assigned to an owner who fixed the error, annotated a summary of the repair, and closed the recorded defect. Integration efforts involved repackaging the Map/Overlay Tool for use in modifying a CITT overlay or training event diagram; integrating the help files and the Instructional Overview of CCTT module; and adding functionality to the Navigate CITT, Produce Exercise Files, and Execute Support Functions forms. The Build 3 database was re-tested by the project team before its release for formative evaluation.

The release of CITT in staged builds allowed the development team the opportunity to find and fix errors and provided a working complement to the CITT design models. The selection of Microsoft Access 97 as the primary development program proved to be an acceptable choice since Access 97 has the flexibility to allow structural changes without losing data and provided a programming environment capable of meeting the functionality requirements. A SQL Server-Visual Basic¹³ solution should be considered for future development owing to the limitations of Access 97. These limitations include no more than two levels of nested subforms, data on forms not responding to filtering or sorting settings, unreliable functioning of hyperlinks stored within tables, and embedded objects occupying excessive storage space when a record is copied. Access 97 proved to be an effective model for migrating to SQL Server and the programs used in developing the CITTDT. Development of the CITTSA guided the design and development of the CITTDT and illuminated areas of the activity models needing additional definition.

Help File Development

A key consideration in the design and development of the CITT was that it must assist the users in accomplishing the tasks that they want to perform. The CITT SOW specified that the design include user guidance in the form of "help" screens and other user-oriented aids to be incorporated directly into the CITT.

¹² Census 97 is a registered trademark of MetaQuest Software, Inc.

¹³ Visual Basic is a registered trademark of Microsoft Corporation.

In the prototype, the team accomplished this by developing and including a comprehensive, integrated help system. The general steps involved in developing a help system include:

1. Create the help topics and structure.
2. Create project files.
3. Create contents and index files.
4. Compile the help file.
5. Test the help file.
6. Integrate the help system with the main application.

Create the Help Topics and Structure. One of the first steps taken in the development of the help system was to review existing software programs and manuals to identify different ways in which on-screen help can be presented to the user. A key reference during this step was The Windows Interface Guidelines for Software Design (Microsoft Corp., 1995b). Based on this review, the project team determined that there were two main forms of help that were most applicable to the CITT: content help and task-oriented help. Content help is best described as providing users with background information that assists them in more fully understanding the activity or process they are performing (see Figure 16). Task-oriented help, on the other hand, provides step-by-step instructions on completing an activity or task (see Figure 17).

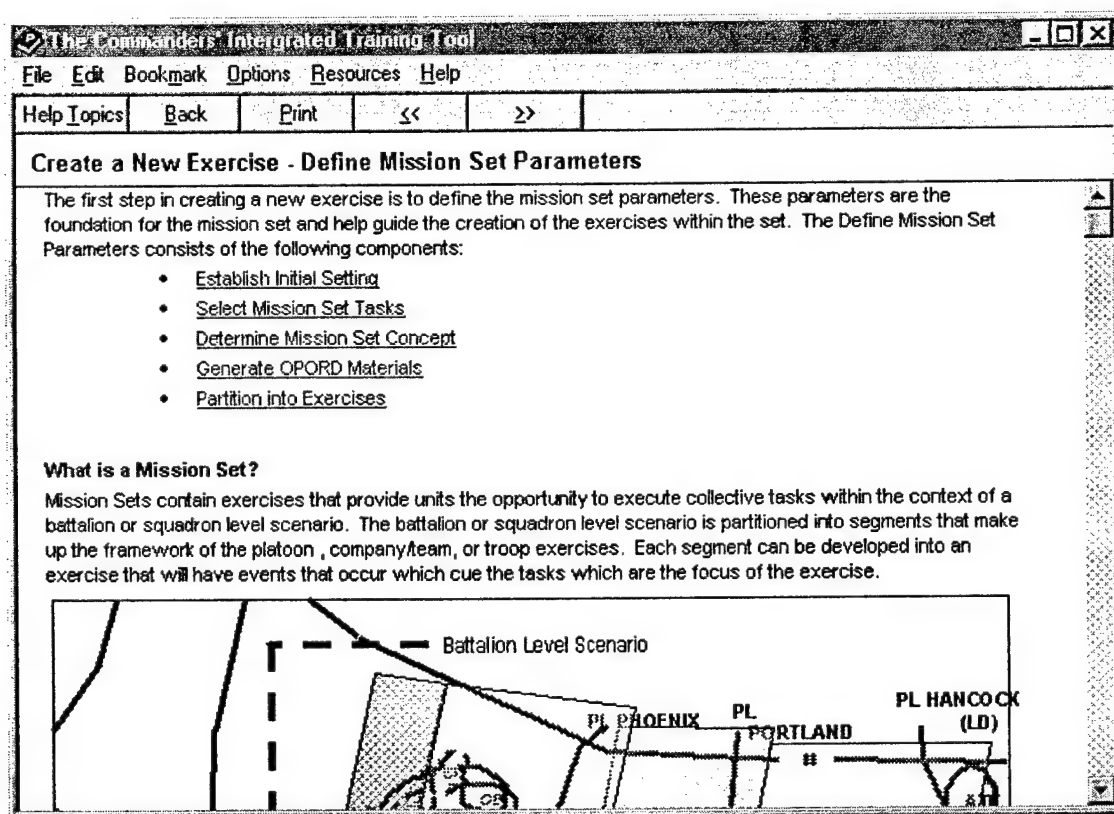


Figure 16. Content help.

With the methodology for providing help determined, the next step was to develop a technique for ensuring that the help would be comprehensive. The team considered two ways: develop help for each individual screen in the CITT, or develop help for each major activity the user would perform. The team selected the second method based on the assumption that activity-based help would cover all of the information the user would need to perform the various tasks available in the CITT. To ensure that the help would attend to both content and task-oriented information, the team developed a worksheet to assist the team in identifying the type of help required for each activity (content, task-oriented, or both) and to ensure that all activities were covered (see Figure 18).

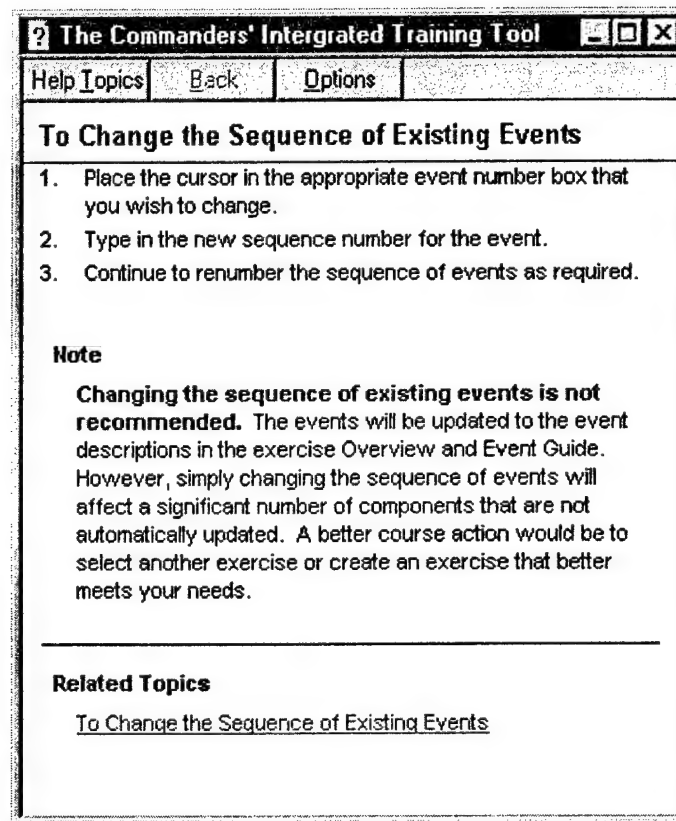


Figure 17. Task-oriented Help.

The first component of the CITT for which help was developed was Select/Review an Exercise. This module was less complex than the Modify an Exercise and Create an Exercise modules. The team then examined the Select/Review an Exercise module of the CITT prototype activity by activity, making very detailed notes about the procedure involved in completing an activity. Next, they recorded this information in the Task Help column of the worksheet, then finished the Content Help column by identifying the information the user would need to assist him or her in completing the activity. The worksheet proved to be very helpful in writing the help for Select/Review an Exercise. It assisted in clearly and thoroughly identifying what information the user would need to be able to successfully use CITT.

Once completed, the worksheet served to guide development of the help content as the team wrote step-by-step instructions. The worksheet was used extensively for Select an Exercise, however, for subsequent modules, the process became more of a mental one, and the worksheet was not used. After completing the Help for Select/Review an Exercise, the team wrote help for the following two components: Modify an Exercise and Create an Exercise. After writing help for these major components, they reviewed it for content and accuracy.

Activity Number: A322			Activity Definition: Select By Criteria		
Task Help			Content Help		
Screen	Topic		Screen	Topic	
A0	A322T1	Select 'Produce Training Materials'			
A4	A322T2	Select 'Select an Exercise' under STX.	A4	A322C2	Information on the CITT training materials. Statement that 'Select Exercise' defaults to 'Select by Task' and user may select the other two methods.
423	A322T3	Select 'Select by Criteria'			
422	A322T4.1	Select echelon using 'Select Echelon'	422	A322C4.1	Definition of echelon naming conventions.
	A322T4.2	Select unit using 'Select Unit'		A322C4.2	Definition of unit naming conventions.
	A322T4.3	Select mission using 'Select Mission'		A322C4.3	Definition of mission naming conventions.
	A322T5.1	Select 'View Matching Exercise'		A322C5.1	Explanation of how search is conducted using 'View Matching Exercises'
	A322T5.1.1	Matching exercises show up on 'Select by Criteria/Select by Mission Set' screen.		A322C5.1.1	Definition of CITT database exercise information.
					Definition of CITT database exercise criteria.
	A322T5.2	Select 'View Exercise Set'		A322C5.2	Explanation of how search is conducted using 'View Exercise Set'
	A322T5.2.1	Enter author code in 'Find Exercise Set'	FES	A322C5.2.1	Explanation of author codes.
					Pull down menu of available authors??
	A322T5.2.2	Click 'OK'			
	A322T5.2.3	Matching exercises show up on 'Select by Criteria/Select by Mission Set' screen.	422	A322C5.2.3	Definition of CITT database exercise information.
					Definition of CITT database exercise criteria.
	A322T5.3	Select 'View All Exercises'			
	A322T5.3.1	All exercises show up on 'Select by Criteria/Select by Mission Set' screen.		A322C5.3.1	Definition of CITT database exercise information.
					Definition of CITT database exercise criteria.

Figure 18. Help Worksheet.

An integral part of the development of the help material was the on-going dialogue among the project team particularly between the software developers and the author of the help material. Frequent discussions with the software developers enabled the author to understand exactly how a certain function of CITT was to work ensuring that the information in the help material was accurate.

Create Project Files. The help materials were written in Microsoft Word format and were then converted and imported into RoboHELP^{®14}, a full-featured help-authoring package for developing Windows^{®15}-based help systems (Blue Sky Software Corporation, 1997a). RoboHELP works in conjunction with Microsoft Help Workshop to simplify the development process by maintaining help content and project files and by integrating those files to develop the help file.

Once the content files were imported, source files and project files needed to develop the help file were created. Source files contain the text and graphics that appear in the help topics (Topic Files), information about the location of topic and graphic files, specifications on how the help windows should look, and settings that customize the way the help file functions (Project Files). The files used to develop the help system were designed, configured, and developed in

¹⁴ RoboHELP is a registered trademark of Blue Sky Corporation.

¹⁵ Windows is a registered trademark of Microsoft Corporation.

accordance with the Windows guidelines (Microsoft Corp., 1995b) and are consistent with the specifications outlined in the Programmer's Manual for the CITT Prototype (Standalone Version) (CITT Team, 1998c). The result of using these guidelines was the development of a help system that was consistent with current standards.

Create Contents and Index Files. Two important features of Windows-based help systems are the Contents and Index tabs. The Contents tab provides users with a hierarchical view of the help system and acts as a table of contents for the help file. Furthermore, it provides the user with a simple mechanism for browsing related topics. Windows-based help systems use a books/pages metaphor to represent categories and topics in the Contents tab (see Figure 19). Book icons represent a category or group of related topics, and a page icon represents an individual topic. The table of contents was developed based on the major CITT functions and the tasks that comprise them.

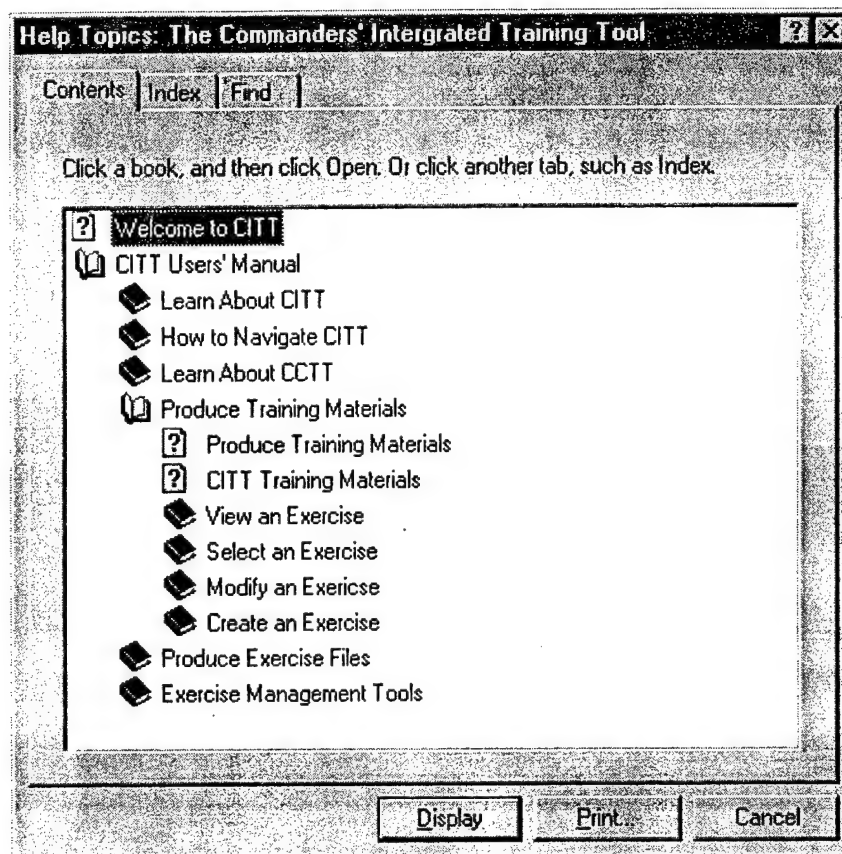


Figure 19. Help Contents Screen.

An Index tab was created to provide users with a list of all of the topics available in the help system organized alphabetically by title and keyword (see Figure 20). The index provides a means to browse quickly through the topics to locate desired information.

Compile the Help File. After the topic files, project files, contents, and index files were created, they were compiled using Microsoft Help Workshop. Applying a technique called data compression, the Help Workshop program packs topic files, graphics, and other project files into a single file that users can display. This process ensures that the compiled help file is as small as possible.

During the compression process, a full-text search capability was developed and a Find tab was created. This allows users to search for any word or phrase contained in the help file (see Figure 21). At the same time the help compiler examines topic files, character formatting, and hyperlinks and translates them into viewable formats.

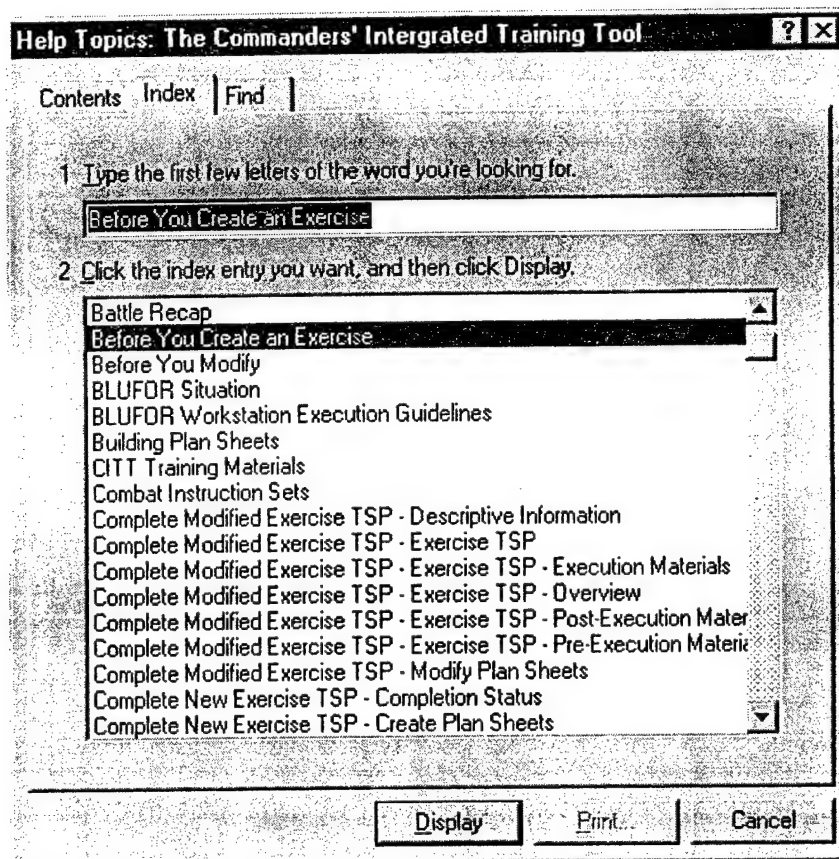


Figure 20. Help index screen.

During the compilation process, the help compiler performed an internal test of the project files. When it located programmatic errors (coding errors), it printed a warning/error message and continued with the compilation. With these errors corrected, the project files were recompiled until all programmatic errors were discovered and corrected.

Test the Help File. After correcting all programmatic errors and recompiling the help file, the team tested the help system for logical errors. Logical errors are programmatically correct, however they do not perform as intended (e.g., they link to the wrong document). These

errors were discovered through a systematic testing process that addressed six areas of help testing outlined in the Microsoft Windows 95 Help Authoring Kit (Microsoft Corp., 1995a):

1. Cleaning up all compiler messages.
2. Checking the index, spelling, and titles.
3. Checking formatting and styles.
4. Reviewing accuracy and style of content.
5. Accessing help from the interface.
6. Testing jumps, pop-ups, and browse sequences.

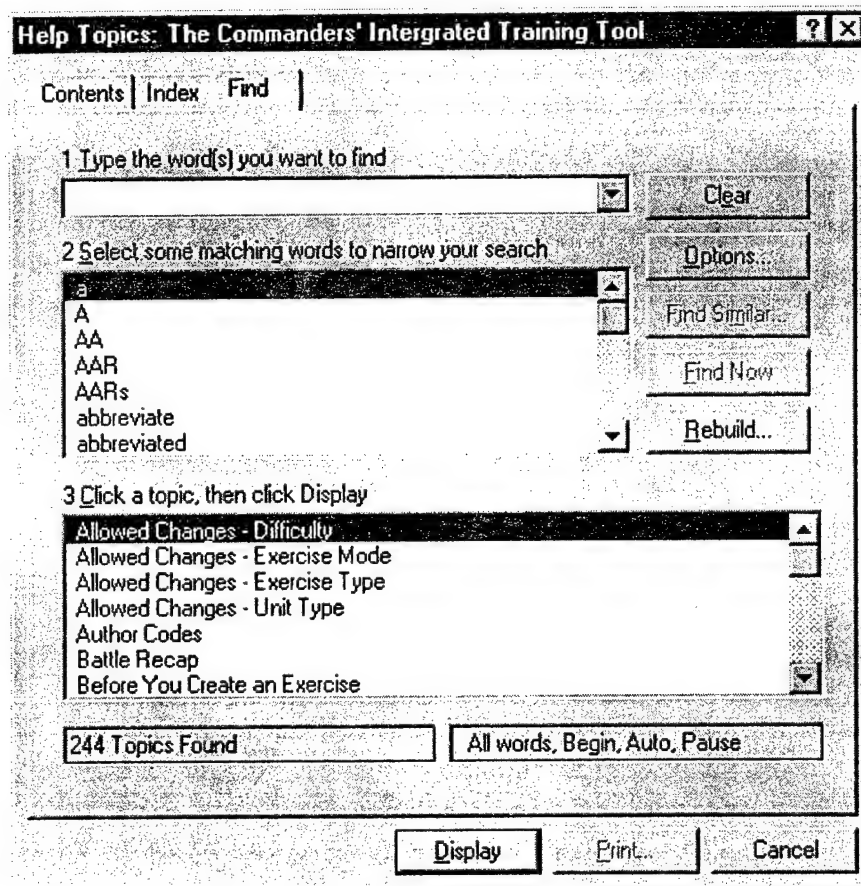


Figure 21. Help find screen.

This testing process uncovered a number of additional errors that were corrected. Internal testing of the help file was a time-consuming and tedious process, however, it was one of the most important steps in insuring that the help file operated as intended.

Integrate the Help System with the Main Application. During the development process, a unique ID was assigned to each topic that made it possible for the main (database) application to find and access the topic. These topic IDs were programmed into the main application. This process connected the help file to the CITT application program and allowed access to the help file. Once the topics were linked to the application, a systematic testing process was implemented and each screen of the application was accessed by the project team, and its

associated help topic was displayed. This process validated the integration process and revealed any missing links. Once an error was discovered, it was recorded in the Census 97 defect tracking software and fixed in the help file. The project team applied this testing process to the complete help system, and they conducted additional testing of the integrated help system during CITT informal user testing and formative evaluation.

Integrate the Instructional Overview into the CITTSA

The final major activity in the development of the CITTSA was the incorporation of the Instructional Overview content into the "Learn About CCTT" module of the CITT. The development and production of the content material was previously described under Task 2.

To incorporate the material into the CITT, the Word files that were produced in Task 2 were converted to HyperText Markup Language (HTML) files using Microsoft FrontPage 98¹⁶. During the conversion process, errors were produced in converting Word formats to HTML. FrontPage 98 and Microsoft Visual Interdev¹⁷ were used to correct these errors as well as to insert additional HTML code, graphics, and scripts. Microsoft Visual Basic[®] 5.0 and Microsoft Script Debugger 1.01 were used to test the source scripts before they were inserted into the HTML code.

Next, the HTML files were imported into RoboHTML^{®18}, which is a development tool based on Microsoft's HTML Help technology (Blue Sky Corporation, 1997b). Microsoft's HTML Help is a set of standards for Help systems based on the HTML format and is intended to provide an alternate way to display help materials (Wexler, 1998). An important advantage of the HTML Help technology is its ability to take advantage of the latest Internet technologies such as Active-X controls, Scripts, and multimedia effects.

Having imported files into RoboHTML, the team used them to develop the Table of Contents that outlines the general structure of the Instructional Overview and an index providing keyword search functionality. They then compiled the files to create the working version of the IO which provides the same functionality as described previously for the help system: full text search capabilities, an index of keywords, and a table of contents. Figure 22 displays a typical screen for the IO.

CITT Distributed

Database Application Development

Although original planning specified staged builds for the CITTDT (as was described above for the CITTSA), this did not occur. Development of the CITTDT did not begin until well after development of the CITTSA, and once it did begin, there was insufficient time to employ a staged build process. The delay occurred for several reasons:

¹⁶ FrontPage 98 is a registered trademark of Microsoft Corporation.

¹⁷ Visual Interdev is a trademark of Microsoft Corporation.

¹⁸ RoboHTML is a registered trademark of Blue Sky Software, Inc.

1. A deliberate decision was made to focus on development of the CITTSA since the project team thought there was greater likelihood that it could be completed successfully.
2. The work that the primary application programmer for the CITTSA was completing as described above for Build 0 was also applicable to the CITTTDT (i.e., Identification of data entities and attributes, the database table and relationship structure, user interface forms), thus it was inefficient to start on the CITTTDT until Build 0 was complete. Since Build 0 included some application development, this gave development of the CITTSA a head start over the development of the CITTTDT.
3. The CITTSA application programmer was an active participant in the CITT design process as opposed to the CITTTDT developers who participated in only a few of the design meetings. Familiarity with the design facilitated development of the CITTSA and led to a decision to develop the CITTTDT based on the CITTSA.

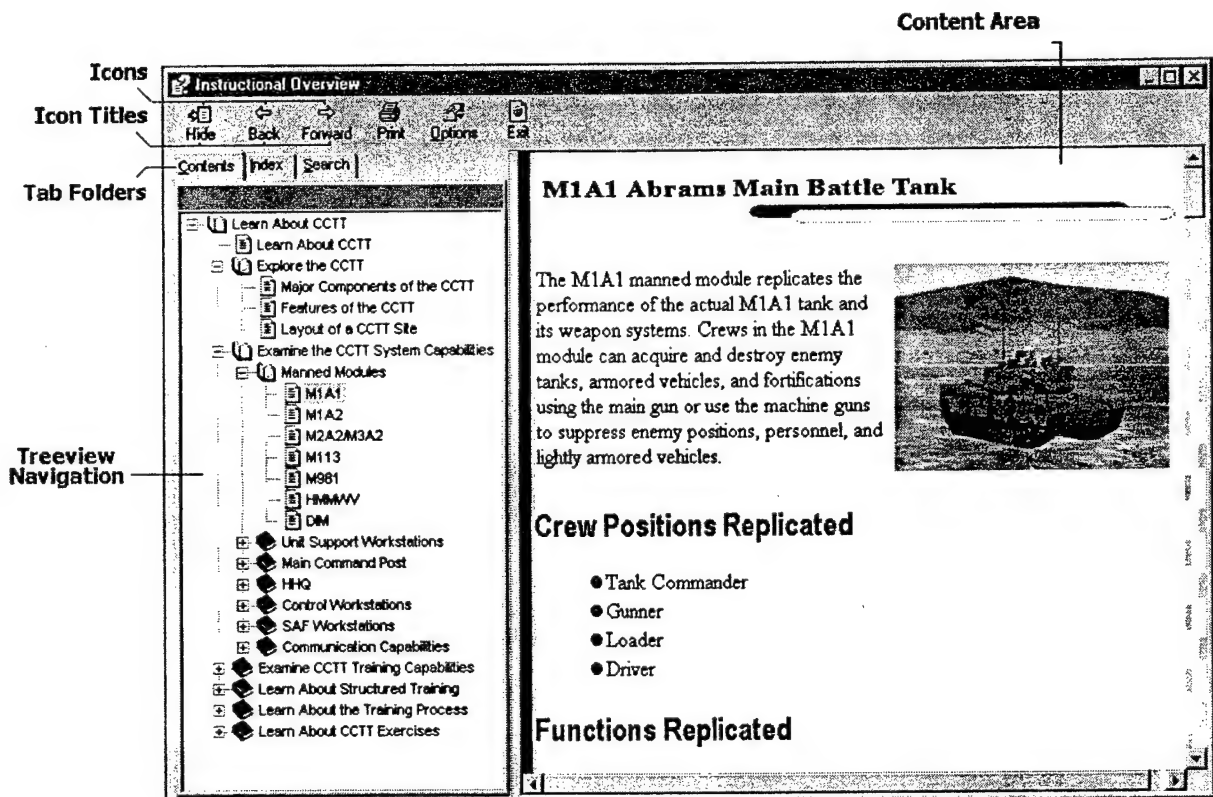


Figure 22. The CITT Instructional Overview.

The development of the CITTTDT began once the CITTSA design and database structure were approximately 90% complete. An initial decision in the process concerned the development software. Access was ruled out since it does not adequately support a multi-user environment that would be required in a distributed application. Instead, Microsoft SQL was chosen which necessitated converting the CITTSA database to SQL. This proved to be a complex process which involved upsizing the Access database into SQL using Microsoft Access

Upsizing Tool. With upsizing, a report was generated that gave the programmers valuable information on required changes to the table structures. This was particularly helpful since it allowed table design modification to be kept to a minimum.

PowerPoint^{®19} files (e.g., maps, overlays) and Word files (e.g., Operations Orders) included in the CITTTSA were not imported into SQL 6.5 due to the inability of the database to store binary large objects. When the Microsoft SQL 7 Beta became available, this limitation disappeared. The CITTTSA data was again imported but this time into SQL 7, and the MSWord and PowerPoint files were converted into binary large objects.

A computer system (server) allowing development and access to the CITTTDT was placed in Louisville, KY for full time Internet access while the application was being developed. This allowed the CITTTDT application developers to easily access the system for development, reduced fears that a server crash would have adverse impact on other servers, and allowed members of the project team at Fort Knox to determine how well the CITTTDT would perform on the actual Internet. As will be discussed below, the project team determined that Internet access speed varies widely depending on time of day and quality of the Internet connection.

The Review and Create components of the CITTTDT were developed using Microsoft Active Server Pages in conjunction with queries from the SQL 7 database. The Active Server Pages utilized SQL 7 views and stored procedures and ActiveX control technology. The Modify component was not completed for the CITTTDT. Figure 23 illustrates the CITTTDT Main Menu screen.

Help File Development

The development of the help files for the distributed CITT was an extension of the development process for the standalone system. Once all files were fully developed and tested for the standalone help system, the team converted files into a format suitable for a web application.

First, the help topics associated with the CITT application were converted to HTML. This conversion process allowed the development team to reuse all the materials previously developed for the standalone system and accounted for over 95% of the files needed to develop the help system for the CITTTDT.

After the topic files were converted, they were integrated into a navigation system. The navigation system is similar in functionality to the tree-view control used in the standalone Instructional Overview. In order to provide the same functionality on the two systems, the distributed CITT utilizes Java applet technology. Therefore, a server-side HTML Help Java Applet was programmed to work with the help system. Figure 24 demonstrates the results of the Java applet.

¹⁹ PowerPoint is a registered trademark of Microsoft Corporation.

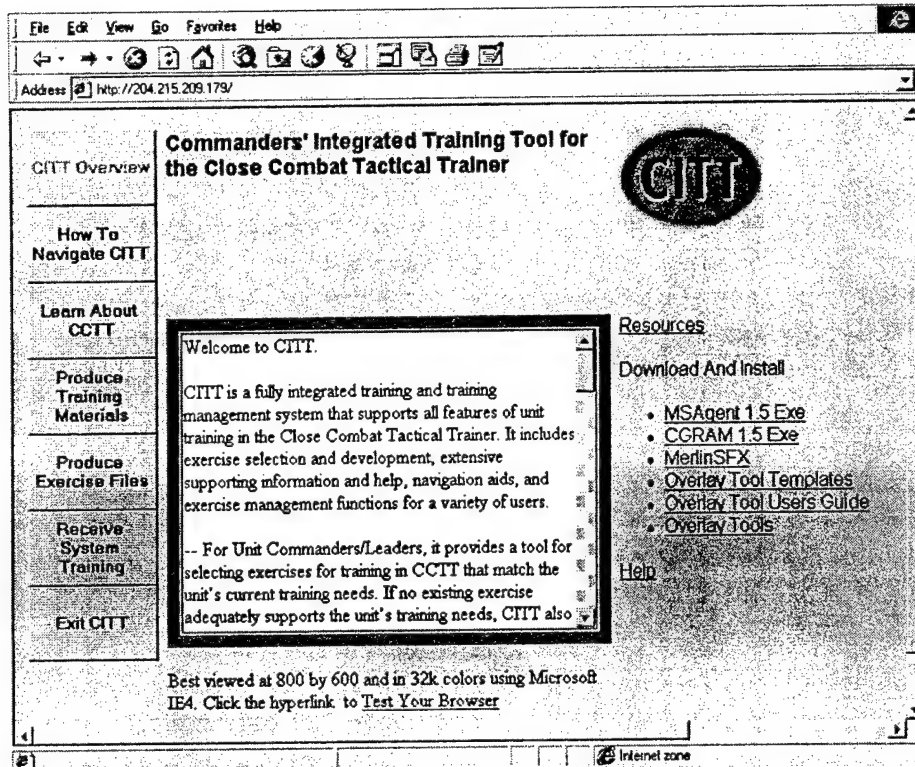


Figure 23. The CITTD T Main Menu screen.

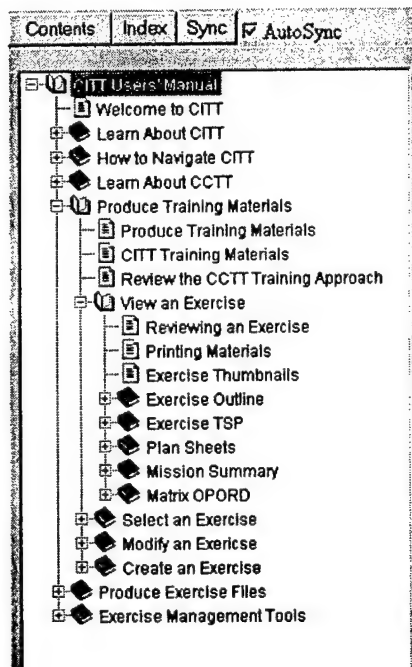


Figure 24. HTMLHelp Java Applet TOC.

A Help Button was provided on each screen of the distributed application and each topic file was linked with its associated screen. The system was designed to allow the user access to the table of contents and index information after a help topic is accessed.

Integrate the Instructional Overview into the CITTDI

The distributed IO was created from materials previously developed for the standalone IO system. Only minor modifications were required because the standalone IO was developed using web-based technologies (HTML, Active-X, VB Script, and Java Script). These modifications included changing the navigation control and removing all large active-movie video clips because of excessive download times. The procedures for implementing the navigation control were identical to those for the Java applet outlined in the distributed Help system section.

After the files were completed, they were uploaded to the distributed server and a link to the IO was added to the main application. Since the distributed IO was developed as a self-contained product, the integration only required placing a button to access the main page. After the IO was uploaded, the development team tested the functionality of the system and corrected errors.

During CITT prototype development, ten user-initiated installation programs to support CITT prototype research development efforts were developed. CITISA installs were delivered by CD-ROM and CITTDI installs were delivered by download. User-initiated installation programs were developed using InstallShield Professional^{®20} 5.1 and InstallShield Package For The Web^{®21} 2.02.

Figure 25 illustrates the final CITT prototype as implemented. The figure applies to both the CITISA and CITTDI versions, however, not all modules and activities were implemented in the CITTDI version. In addition, a representative sample of annotated screen shots from the CITISA Modify Exercise and Create Exercise activities are included in Appendix C. These screen shots provide a "feel" for the CITT system as it is would be used to produce a TSP.

Task 5: Develop an Implementation Strategy and Fielding Plan

To maximize the CITT's effect on training in the CCTT across the Army, training developers must create an effective implementation strategy. This strategy must take into consideration the full range of individuals who will use the CITT including remote users and system administrators. In addition, the strategy must address compatibility of the CITT with Army training information management systems and databases such as the SATS and ASAT. This section will examine three possible methods for implementing the CITT:

1. CITT fielded specifically to support CCTT.
2. CITT fielded as a standalone component of SATS.
3. CITT fielded as a component of an integrated training tool.

²⁰ InstallShield Professional is a registered trademark of InstallShield Corporation.

²¹ InstallShield Package for the Web is a registered trademark of InstallShield Corporation.

Development of a strategy that incorporates CITT into the Army's existing automated training management architecture will offer the most long-term benefit for the Army.

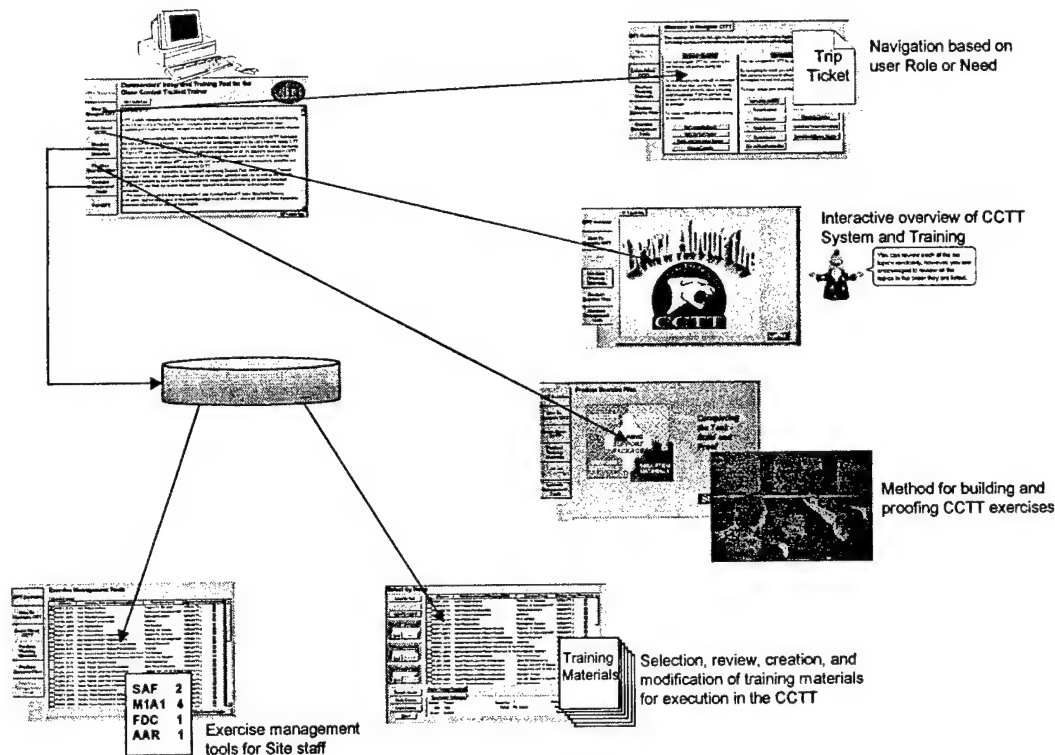


Figure 25. The CITT prototype.

The CITT Fielded Specifically to Support CCTT

Since the CITT is designed to support training in the CCTT, a near-term method for implementation would be fielding it specifically to support CCTT. This would entail providing access to CITT for those installations that have CCTT and those units who use CCTT. The CITT would be placed at each CCTT site including mobile sites allowing users to develop training products based on subject matter expertise provided by the CCTT sites. The CITT would also be placed in units to further facilitate the unit's development of training products for CCTT. A cost-benefit analysis would be performed to determine the appropriate echelon at which to place the CITT. This alternative is illustrated in Figure 26.

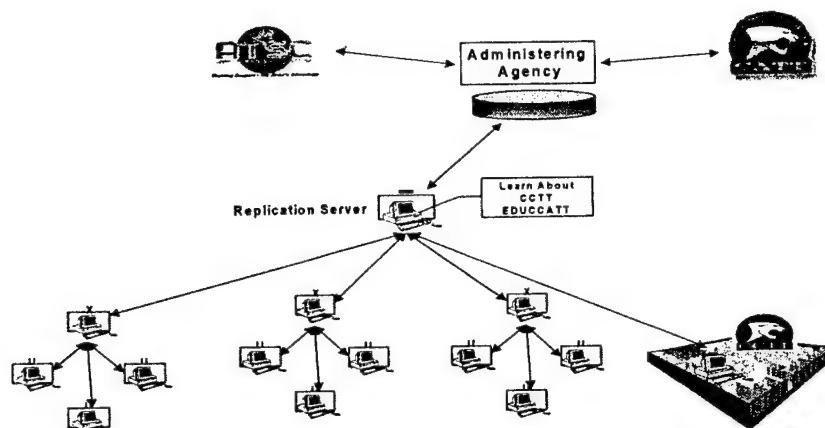


Figure 26. The CITT Fielded to Support CCTT.

To support sharing of training materials and lessons learned for training in CCTT throughout the Army, an army-wide database would be established to store developed training products and lessons learned. An administering agency would be identified to manage and maintain the database allowing units to review training materials developed by other units as well as lessons learned from training in CCTT. To support units in obtaining information, a dedicated replication server would be used at each installation. The replication server would also be used to store common data that all users need such as Learn About CCTT or EDUCATT. The administering agency would receive updates from ATSC, PM-CATT, and TSM-CATT to ensure the database stays current. Updates would include such information as new CCTT capabilities or updated ARTEP-MTP tasks.

This alternative would provide units with access to the CITT allowing them to produce training materials for use in CCTT. It could also allow CCTT sites to assist units in their preparation of training materials. This alternative could be implemented relatively quickly with hardware being the primary expense. However, the alternative also allows for little or no integration with existing Army training information management programs. It would create an additional training program that users would need to learn and could conflict with the movement to consolidate training management programs.

CITT Fielded as a Standalone Component of SATS

The second fielding alternative is to integrate CITT as a standalone component of SATS. SATS, based on the Combined Arms Training Strategy, is an integrated tool that enables a trainer to develop unit-specific situational training and manage training resources. SATS provides users with information on available resources and helps identify training priorities. Once a resource has been identified for use, SATS includes a TSP module that allows users to develop a TSP for a training event. Figure 27 illustrates this alternative.

Integration of the CITT as a standalone component of SATS would be relatively simple. As users indicate their intention to use CCTT and enter the TSP module, SATS would link them to the CITT. Once they are in CITT they would be able to develop a TSP to support their training in CCTT. Under this alternative, the CITT would be distributed as an additional CD-ROM with the SATS CDs.

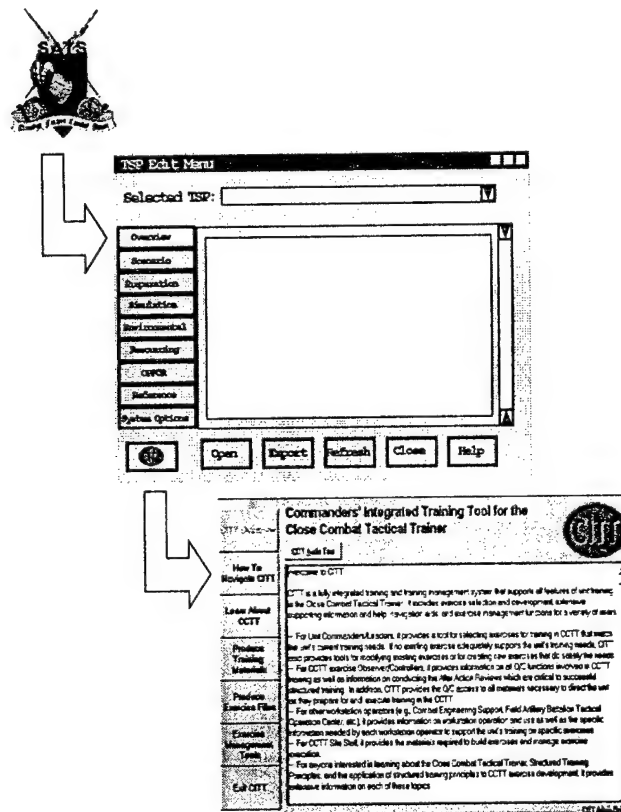


Figure 27. The CITT Fielded as a Standalone Component of SATS.

Investigation will be required to determine the best method for linking the CITT to SATS including the information that could be carried forward from SATS into CITT. For example, collective tasks identified during the planning of training could be integrated into the CITT TSP to preclude the user from having to identify collective tasks again when they link to the CITT.

This alternative requires compatible hardware and software for CITT and SATS and allows for the fielding of CITT as a component of SATS, thus avoiding placing an additional training information management program into the Army's training architecture. It also allows for CITT to be fielded in accordance with the distribution plans for SATS. One drawback to this method, however, is that it would provide trainers with a tool that addresses only one training resource—CCTT.

Integrated Training Tool

The third alternative focuses on development of a truly integrated training tool that allows users to develop training products for different training events occurring in live, virtual, or constructive environments. This integrated training tool would also include information that is common to all training events and environments and would support a variety of TSP formats tailored to the methods of training in different environments. Examples of common information are training management and training approaches. It would be possible to integrate this tool into SATS and ASAT providing a common training development tool for the Army as a whole. Figure 28 illustrates this alternative.

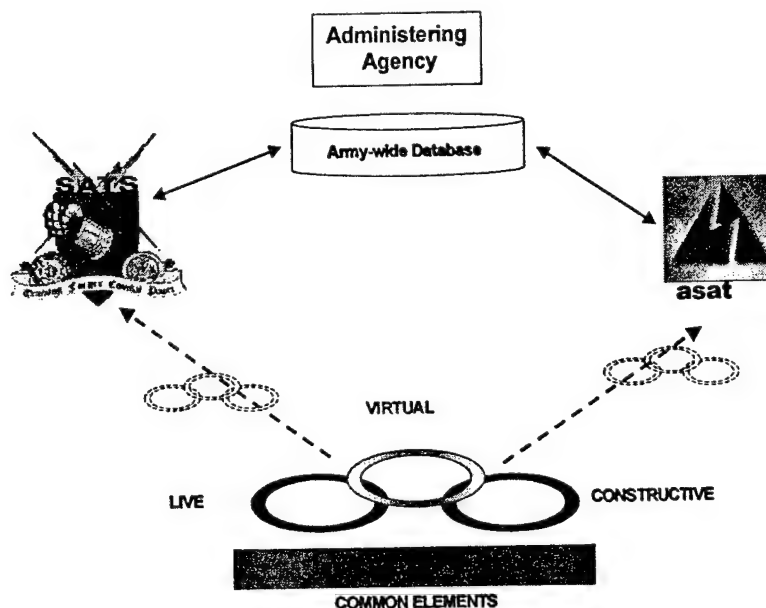


Figure 28. An Integrated Training Tool.

This alternative offers the advantage of building on existing training information management programs with which users are familiar while adding additional functionalities that allow the user to develop TSPs to support a variety of training events.

To implement this alternative an administering agency would be identified. A logical candidate would be the ATSC since they currently administer SATS and ASAT. Since the integrated training tool could be a component of SATS and ASAT, it would be fielded based on their distribution plans. This provides access to the integrated training tool at the company level for units in the field. In the proponent schools, access will be provided to the appropriate agencies tasked with training development. To provide access to developed training materials and lessons learned throughout the Army, products developed with the integrated training tool would be stored in an Army-wide database such as the Center for Army Lessons Learned or ADTDL.

Figure 29 illustrates a possible fielding structure for this alternative. As shown, SATS is fielded to the company level and higher. Users would have a client workstation capable of running SATS with the integrated training tool. A higher headquarters would be able to provide training guidance to subordinates and review training materials developed based on that training guidance. Training materials or exercises that are determined by higher headquarters to be effective would be placed in the Army-wide database after being approved by the chain of command.

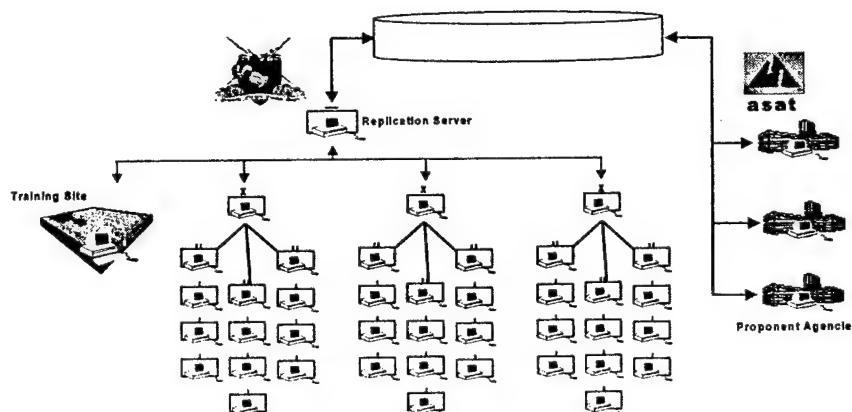


Figure 29. Integrated Training Tool Fielding Strategy.

Users at proponent agencies would use the same integrated training tool as that used by units in the field. By accessing the Army-wide database, users at the proponent would review the training being conducted by field units and would place updated training information, i.e. updated collective tasks or new simulation capabilities, in the Army-wide database. This would encourage a sharing of information between the user in the field and the training developer at the proponent.

As with the CITT fielded to support CCTT alternative, a replication server would be used to echelon information. By storing information in an Army-wide database, the efficiency of user's computers will be improved. Updated training information, instructional modules on different training environments, and exercises would be stored in the database. These could be downloaded based on the users' needs thus allowing them to tailor the information on their local computer to best support their needs.

Users would have the application loaded on their computer as well as the information they have downloaded from the Army-wide database. This provides trainers in units and training developers at proponent schools an identical training tool. The application would allow them to develop training materials to support live, virtual, or constructive training for individual, collective, or leader training programs.

Common Issues

The three alternatives discussed above share several fielding issues. One involves access. Under each alternative, the same method for providing access to remote users could be used. Users would register on-line with the administering agency and receive a scaled down version of the application on CD-ROM. Users would then access the Army-wide database to use functions not included with the CD, obtain up to date training information, and view exercises in the database. As users develop training materials, they would transfer them to their unit for inclusion in the Army-wide database. Transfer of training materials would occur via electronic mail or disk depending upon the size or the electronic files. This is illustrated in Figure 30.

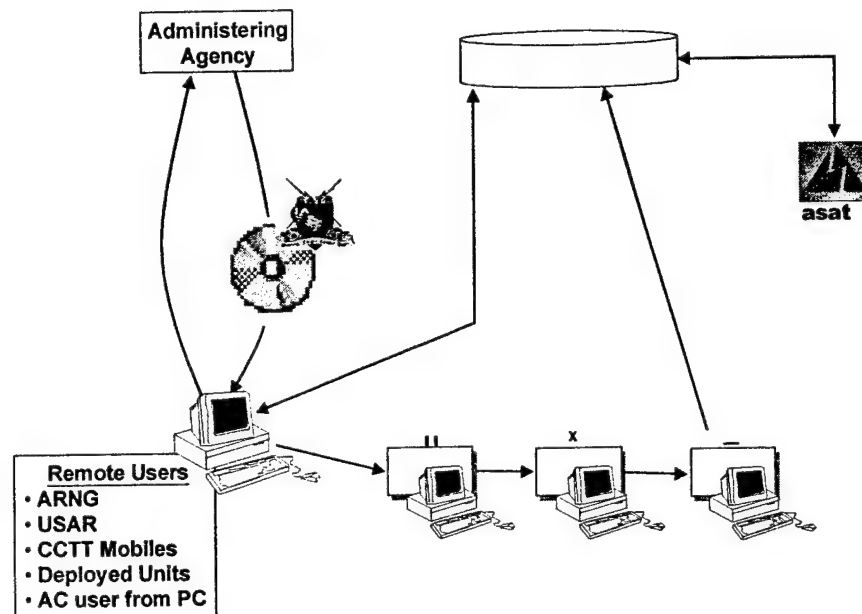


Figure 30. Remote Access to the Integrated Training Tool.

A second common issue concerns connectivity with training sites. For maximum effectiveness, appropriate training sites, such as CCTT or WarSim 2000, would be equipped with the same type of client workstation as that located in units and proponent agencies. This would allow units to transfer developed training materials to the training site that will support them during execution of the training. Ultimately this transfer of training materials would result in a user being able to develop a virtual or constructive exercise and send it directly to the training site. To identify ways to accomplish this without putting training sites at risk of infection from computer viruses will require further investigation.

A final common issue concerns the hardware the user will need to efficiently run the integrated training tool application. Experience from the formative evaluation of the CITT showed that the average unit will probably not have a computer powerful enough to efficiently operate a large training information management program. The user in the field will need to be equipped with an adequate computer. Table 2 lists recommended basic hardware requirements

based on the computers being purchased for the West Point class of 2002. A computer meeting these specifications could be purchased today for less than \$3000. Ideally, this computer could be purchased for each user at the time an implementation decision is made.

Table 2. Recommended System Configuration for Fielding an Integrated Training Tool.

Component	Specification
Chip Set	Pentium 450
RAM Access Memory	128 Megabyte
Hard Drive	12 Gigabyte
Compact Disk-Read Only Memory	DVD II ROM Drive
Video Card	Video Graphics Adapter with 4 Megabyte Video RAM
Sound Card	Sound Blaster Compatible with Speakers
Modem	56.6 Kilobits per second
Screen Display	17" Monitor, 800 x 600 resolution
Operating System	NT Workstation 4.0 with Service Pack 3
Browser	Internet Capable
Other Applications	Word Processing, Spreadsheet, and Graphics

In summary, all three alternatives for implementing an integrated training tool would allow the user to develop training materials for use in CCTT and all three share common fielding issues. The primary difference between them is in their different level of interaction with other Army training systems. Only the third alternative involves complete integration to ensure synchronization with existing systems and would reduce the number of new systems the user would need to learn to use.

PROJECT EVALUATION ACTIVITIES

Evaluation activities for the CITT Project needed to take into account that the design of the CITT is the primary product of the project. As described in Task 3, the CITT design is not a product in the traditional sense. Rather, the design is a conceptual process depicted in a series of IDEF models, ICOMs and FEOs, Node Trees, and Activity Listings. The evaluation of the design can, at least partly, be accomplished by obtaining the opinions of individuals with expertise in the area of system modeling, but ultimately it must wait for implementation in order for a complete evaluation to be conducted. On the other hand, the project did produce products in the form of the CITT videos and the prototype. Those products were more amenable to traditional evaluation procedures. In addition, the project itself was completed in the context of a quality assurance model which looks not just at the products, but also at the activities that produced them. According to Stebbing (1986), "the ultimate purpose of any quality assurance

scheme is to ensure complete satisfaction by the customer with the goods or services provided by the supplier...the real evidence of quality must be seen to exist, not only in the completed item but in all activities which are involved in completing that item..." (page 8).

The project team established review procedures to assess the project activities and to assure that the project remained on track and was achieving its objectives. The primary assessment of the CITT design was through this review process as was the assessment of the videos. The review procedures included a combination of team meetings, and technical reviews. The primary testable product, the prototype, was assessed through a series of evaluation activities beginning with internal software testing and proceeding through formative evaluation. The remainder of this section will report on the CITT Project evaluation activities and their results.

Review Process

Early in the project life cycle, various military standards were researched and examined to determine their applicability to this project. The project team decided to adhere to MIL-STD-498, Software Development and Documentation. (DoD, 1994).²² The selection of MIL-STD-498 provided the project team with a standard against which project activities and the outcomes of those activities could be judged.

At the heart of the review process was the recognition of the need for frequent and detailed communication among team members and between the project team and the project sponsors. Reviews occurred within the context of team meetings, technical reviews, COR reviews, TSM reviews, and In-process reviews (IPRs). These reviews were critical to the success of the project.

Team Meetings

In the early stages of the project, team meetings were held frequently—at least weekly and at times more frequently. These frequent meetings provided an open forum for discussion among team members which was particularly important since the project team members had become somewhat segregated along the lines of Tasks 2 – 4. It was important that everyone involved knew, at least at a general level, what was happening in all phases of the project. The evaluation specialist kept notes for the team meetings.

It was also at team meetings that the team made important decisions related to the ongoing conduct of the project. It was in a team meeting, for example, that the team decided to adhere to MIL-STD-498. It was also in a team meeting that discussions regarding how to get modeling back on track occurred when that process started to bog down. Many early decisions regarding the design and development of the prototype occurred at team meetings as did early discussion of the design of the Instructional Overview and videos.

²² MIL-STD-498, was canceled 27 May 1998. The information is now contained in Institute of Electrical and Electronics Engineers (IEEE)/Electronics Industries Association (EIA) standard, IEEE/EIA 12207, "Information technology-Software life cycle process". This change had no impact on the evaluation process for the CITT Project.

Although at times there was considerable disagreement among team members, team meetings were always conducted in an open manner where everyone felt free to provide his or her opinion, and where everyone's participation was treated with respect. This was the key to the success of the meetings.

Technical Reviews

Technical reviews had originally been planned as part of Task 4 and were intended to provide a weekly check of the development of the prototype. In actual practice, they became a more formal extension of the team meetings and all areas of the project were included. These reviews were scheduled to occur weekly for 11 weeks but actually ran 14 weeks. The team conducted technical reviews very similarly to the team meetings, although an agenda was typically published prior to the meeting and was generally followed during the meeting. Because of the timing of the technical reviews, the prototype development usually dominated the meeting, however, as indicated above, the team considered all phases of the project.

As with the team meetings, the technical reviews were very important to the project in terms of identifying problems early and determining the best strategy for dealing with them. In addition to problems with the prototype, other problems identified included difficulties with video production, problems with COTS software that had been selected for project development, and problems with the design tools and software.

COR and TSM Reviews

To obtain feedback from the COR and the TSM on a timely basis, frequent meetings occurred with one or both to review project activities and products. COR reviews were generally informal briefing sessions and were tied to major project decisions, activities, and products. For example, the COR and ACOR received briefings on and reviewed early drafts of the video scripts, the quality assurance plan for the project, early design considerations for the CITT, and prototype specifications among others. TSM reviews were more formal and were generally tied to completion of major products. For example, the TSM reviewed final drafts of video scripts, later drafts of design documents, and the actual working prototype among others. By obtaining feedback via these reviews, the project team could address concerns of the project sponsors on a timely basis. This helped to ensure that the project would meet the sponsor's needs as originally stated in the SOW.

In-process Reviews

A total of four In-process Reviews (IPRs) occurred during completion of the CITT Project. Consistent with the primary goal of the project, the IPRs focused on the design of the CITT. Detailed briefings were provided at each IPR and feedback was obtained from the COR, TSM, PM-CATT, ATSC, proponent schools, and other government representatives. The IPRs served the very important function of providing information to and obtaining feedback from a relatively large group of individuals representative of the ultimate sponsors, providers, and users of the CITT.

The critical aspect of the complete review process employed in the CITT Project was that it provided for frequent feedback to the project team from an ever-expanding cadre of reviewers. The frequency of the reviews needs to be underscored. Because of the way the project was being completed, individuals or small groups were making decisions and taking actions that potentially had large impact on the final outcome of the project on an almost daily basis. All such decisions and actions were subject to review within several days at most either within the project team or outside the team as necessary. In this way, the likelihood of detecting and correcting decisions and actions that might have negative impact on the project was maximized and was done in a very timely manner.

One final point needs to be discussed before concluding this section. As stated above, the major product of this project is the CITT design—a design subject to detailed review throughout the project up to and including all three IPRs. In addition, the design was reviewed by subject matter experts in information systems design from ATSC who reviewed the design early in the project and then again as the design was further refined. Their feedback assisted the project team in better understanding some of the more complex rules of activity modeling as well as providing objective feedback on the logic and detail of the CITT design. This guidance and feedback assisted the project team in refining the CITT design to more accurately and consistently illustrate the activity and function of the application.

Prototype Evaluation

The prototype was subjected to a multi-stage evaluation strategy beginning with internal software testing conducted by members of the project team and continuing through three levels of user testing (User Jury testing, informal user testing, and formative evaluation.) Keep in mind, however, that while the testing process can be described as a linear one, the actual process is very interactive. That is, internal software testing for one unit might be occurring at the same time user testing was occurring for a different unit. For example, user testing was being conducted on the Select an Exercise and Review an Exercise modules at the same time the Create an Exercise module was undergoing software testing. Furthermore, the results of testing may well impact development in both directions—units that are further along in development and those which are not as far along. So, for example, it was not uncommon for user testing of the Select an Exercise module to have impact on the Create an Exercise module, nor was it uncommon for software testing of the Create an Exercise module to have impact on the Select an Exercise module even though it was further developed. Due to its earlier completion and greater functionality, more testing was completed on the CITTSA than on the CITTDt version. The testing of the CITTSA will be described and differences in testing of the CITTDt will be noted.

Internal Software Testing

During software development, the team employed a Software Quality Assurance Program (SQAP) to detect and correct as many defects as possible as early as possible. The SQAP consisted of unit testing, source-code tracing, integration testing, and system testing. Defects identified were entered into a defect-tracking database using Census 97.

Software unit²³ testing involves informal testing of source code by the developer who wrote the code. A software unit can refer to a subroutine, a module, or even the complete program. As the developer completed a unit of code, he or she checked it for logical errors, syntax errors, etc., which were corrected immediately. Errors found and corrected at this level were generally not entered into Census 97.

Simultaneously with, or immediately following software unit testing, the developer completed source code tracing using an interactive debugging program. That is, the code was analyzed step-by-step using a program designed specifically to identify coding errors. As with unit testing, errors were corrected immediately and were generally not entered into Census 97. The purpose of both unit testing and source code tracing was to identify and correct programming errors prior to integration of the code which greatly reduced integration errors.

After software units had been tested and defects corrected, integration testing occurred as units were brought together and integrated into the CITT. In integration testing, the code is exercised as a complete entity to determine if it functions as needed. As newly developed software units are integrated with existing software, integration testing is repeated. Defects discovered in integration testing were corrected immediately, if possible, in which case they were generally not entered into Census 97. However, if a defect was not immediately correctable, it was entered into Census 97 for tracking and correction later in development.

The final stage of internal software testing was system testing. Unlike unit, source code, and integration testing, system testing was conducted by other members of the development team rather than by the developer who wrote the code. This was done to preserve objectivity. For the most part, the project manager and the evaluation specialist performed system testing. The testers exercised the software in an attempt to "break it," and, when defects or errors were found, they were entered into Census 97. System testing was begun when the Select an Exercise and Modify an Exercise modules were complete and continued throughout the remainder of the development of the CITTSA. All defects identified as a result of system testing that could be fixed in the prototype were fixed and were marked closed in Census 97. Resolution was not possible for some problems in the prototype primarily due to limitations in the development software. These were referred to possible future development, and, if appropriate, were referred to the CITT designers for an analysis of possible impact on the design. Of 148 entries in Census 97, approximately 40% resulted from system testing indicating that a substantial number of problems were found and corrected prior to user testing.

Internal software testing for the CITTDT followed a different process primarily because of the nature of the development process itself. The CITTDT is not an application in the same sense as the CITTSA, that is, it is not an integrated software program. Instead, it is a collection of active server pages that run across an Internet connection. Each page is built and tested as a separate entity. As a page is being developed, the developers get immediate feedback on whether or not the code behind the page is working as intended. If it does not, modifications are made immediately and the page is tested again. This iterative process of development and test

²³ Unit, in the context of software testing, is an industry-wide accepted term and refers to testing of software code. It will be used throughout this discussion and should not be confused with a military unit.

continues until the page works. System testing did occur in that non-developers accessed the CITTDT and attempted to "break" it much as they had for the CITTSA. Problems and defects uncovered through system testing were entered into Census 97 and were provided to the CITTDT developers.

User Testing

User testing is being employed broadly to cover all testing involving test participants from outside the development team. The overarching concern of all levels of user testing was improvement of the CITT prototype. The purpose of user testing was not simply to detect and correct errors in the prototype itself, but also to determine how users responded to the CITT in terms of such variables as ease of use, ability to accomplish specific tasks, value of the information presented, etc. To this end, data were collected from User Jury testing, informal user testing, and formative evaluation.

User Jury Testing

As described earlier under Task 4, the government identified a User Jury consisting of as many as seven individuals, primarily military personnel representative of the CITT user population. Early in the design of the CITT, the jury was used for the purpose of assisting the project team in making design decisions primarily in the area of user interface and screen appearance issues. This was the intended function of the jury as described in the Research Program Plan. However, in later sessions, as the prototype was being developed, the jury was asked to provide reactions to the CITTSA as it was actually being implemented. They were provided with either screen shots of the prototype or the prototype was running on a test machine, and the jury members were asked for their reactions regarding how the CITTSA was being implemented. Out of a total of six meetings of the jury, the last three were at least partially concerned with obtaining the jury's reactions to the prototype.

Based on User Jury feedback, a number of modifications occurred to the prototype. Recommendations made and followed regarding general issues included naming conventions for buttons that were used on-screen, the location of buttons on the toolbar and on-screen, and the need for consistency in navigation, as well as specific comments related to individual screens.

In general, the jury provided valuable information to the development team, and, on balance, was a productive use of resources. However, the overall value of the jury was probably limited due to a number of factors. It was very difficult to get all members together at the same time. Several meetings were conducted with as few as four of the members present. Meetings were deliberately kept to 90 minutes which sometimes was not enough time to allow for sufficient discussion of issues. And, the project team broadened the scope of the jury to include issues related to CITT design beyond the original intent. This resulted in less time being spent on user interface and system usability issues.

Informal User Testing

To distinguish this testing from that planned for formative evaluation, the team used the term "informal user testing." Informal refers to the test atmosphere rather than to the manner in

which testing was conducted; sessions were conducted less formally than those in formative evaluation, and there was more interaction between the test participants and the observers. Informal user testing began on 21 July 1998 and continued through 20 August. Fourteen test sessions were conducted for a total of 34 hours of testing. Test cases consisting of directions to the participants regarding the tasks they were to complete and the outcomes they were to produce were created for each session as per the Research Program Plan. Participants for the initial sessions were civilian government employees who were given fairly broad cases, e.g., they were instructed simply to examine CITT and see if they could "break" it. Later sessions were run with military personnel and involved more specific test cases, e.g., "access CITT and go through Learn About CCTT." Two members of the project team observed each test session and recorded observation data on pre-printed forms. The team determined early in informal user testing that two observers were required and that at least one of them needed to have expertise in structured training and TSPs. This finding proved important in later planning for formative evaluation.

The observation procedure employed for informal user testing is best termed "active." That is, the observers offered assistance to the test participant if they thought he or she was having difficulty, or they probed for additional information from the participant when an action he or she had taken was unclear. Active observation was appropriate for informal user testing since its primary function was to find and correct problems with the CITTSA as opposed to determining if the CITTSA supported the user in selecting, modifying or creating an exercise. The latter was the function of formative evaluation. Observers recorded actions taken by the participant, problems the participant had completing an action, problems with the CITT itself (e.g., buttons not working, incorrect links, forms working improperly, etc.), and questions and comments the participant had. Following each test session, a summary report was prepared for the session.

On approximately a weekly basis, the observers met to analyze the test results from the sessions conducted that week. The summary reports served as the basis for the review and discussion during these meetings. Based on the analysis, the observers listed problems with the CITT and/or enhancements to the CITT that needed to be made in the prototype. They also decided what changes/modifications could not be made in the prototype and whether they would be incorporated into the CITT design. Changes/enhancements to the prototype were entered into Census 97; implications for design were given to the CITT designers. Thirty to forty percent of the items in the Census 97 database resulted from informal user testing.

Formative Evaluation

The CITT SOW specifically called for the refinement of the prototype CITT through formative evaluation (FE). This was addressed in the Research Program Plan under Beta testing, and this terminology was used in the early months of the project. On further analysis, however, the team decided that formative evaluation is the more precise term to describe what was planned and what actually occurred, and that terminology will be used for the remainder of the report. Formative evaluation, as described by Scriven (1991) is evaluation typically conducted during development of a product with the intent to improve the product.

Formative evaluation plan. In February, 1998, a plan for completing FE was presented to the COR. The plan addressed three primary objectives taken directly from the SOW. Specifically, FE was to assess the ability of commanders and other unit trainers to:

1. Select, modify and develop CCTT exercises for platoons and company teams.
2. Access, modify, develop and print required training support materials.
3. Execute fully the exercises as selected, modified or developed.

The first two objectives are "internal" to the CITT, that is, they do not require the test participants to perform any actions outside of those included in or supported by the CITT. The third objective, on the other hand, is assessing actions or functions "external" to the CITT, that is, can exercises selected, modified, or created be fully executed at the CCTT site. This means involving additional personnel such as workstation operators and site personnel and requires two additional FE objectives. Specifically FE needed to determine the CITT's ability to:

4. Provide other unit personnel with the capability to access required information necessary to support the execution of exercises created or modified.
5. Provide CCTT site personnel with the capability to build exercises that have been created or modified.

As described below, due to scheduling problems, there was insufficient time to build the exercises created during testing limiting FE to three of the above objectives (the first, second and fourth.)

The FE plan identified several constraints that impacted data collection:

1. Testing was to be conducted using members of the target population for whom the CITT was being developed, specifically soldiers from Fort Hood and Fort Knox.
2. Testing was to be balanced between the two prototype versions.
3. Test participants were to be drawn from both active and reserve (including Army National Guard) components of the Army.
4. Evaluation data were to be collected using two primary methodologies:
 - a. Passive observation in which users were monitored (both by the CITT team and by the CITT system) as they used the system. Observation was passive in that the observers would not offer help or guidance to the participant. All problems/deficiencies encountered were recorded either by the CITT or by observers from the CITT team,
 - b. Surveys/interviews of users involved in the FE were conducted by the observers.

During FE, data were to be collected by monitoring test participants as they completed a test case, and by interviewing and/or administering questionnaires to test participants. Test cases (i.e., the specific scenario for using CITT which a participant was asked to follow) were developed to fit the training needs of the Fort Hood units; additional test cases were developed for testing at Fort Knox in order to exercise to the maximum extent possible all of the CITT functionalities. Passive monitoring was employed during testing, and participants completed the embedded questionnaire (see Appendix D). On the other hand, it was not possible to include embedded data collection tools in the CITT itself, thus this method was not employed. The Data to be collected during FE included:

1. Time to complete each module.
2. Paths taken through CITT cross referenced to test case.
3. Successful outcome reached (e.g., exercise was selected, created, modified; participant able to access EDUCCATT to utilize workstation training, etc.).
4. Navigation errors (i.e., participant had to "back up" to get back on task; participant went down a path that did not lead to desired outcome).
5. System errors (e.g., links not working correctly, buttons not working, help screens not working, etc.).
6. Usability measures (e.g., "look and feel", ease of navigation, ease of use, etc.).
7. Functions and features omitted.
8. Desired system changes.
9. Difficulties encountered/errors made during exercise build.
10. Difficulties encountered/errors made during exercise execution.

Finally, a timeline was included with the plan which specified identification of the test unit four months prior to its CCTT training. This allowed for testing of the CITT prototype one-and-a-half to two months prior to CCTT training, thus providing the CCTT site personnel sufficient time to build and proof the exercises created or modified using CITT. When the unit trained at the CCTT site, they would train on the modified/created exercises, thus allowing testing of objective 3. This schedule was consistent with CCTT site requirements.

Approximately two weeks for CITT testing would be required at Fort Hood and one week at Fort Knox. In addition, a week at Fort Hood would be required to build/proof the exercises, and two weeks would be required to test whether the exercises were fully executable by the unit.

Implementation of the plan. For a variety of reasons, the actual FE of the prototype varied from the plan in a number of important ways. First, units were not identified until August. In early August, the COR and project manager visited the squadron at Fort Hood to discuss the testing schedule. Units were scheduled for CCTT training the weeks of 28 September and 5 October, and the only time available for testing the CITT was the week of 14 September. This had two major effects. The amount of testing at Fort Hood had to be reduced and the amount of testing at Fort Knox had to be increased. More importantly, from a testing standpoint, there were only two weeks at most for the CCTT site personnel to build and proof exercises which was insufficient. The build/proof test and the execute exercises test were abandoned. As stated above, this limited FE to a test of three of the five objectives.

Another variance from the plan concerned the testing of the CITTSA versus the CITTDI. As described under Task 4, development of the CITTDI lagged significantly behind development of the CITTSA. Because of this, the project team decided that all testing at Fort Hood and the majority of testing at Fort Knox would be conducted on the CITTSA. Testing of the CITTDI was limited primarily to the Learn About CITT and Select and Review Exercise modules.

Following negotiations with the test units, the testing schedules for Fort Hood and Fort Knox changed, and these are shown in Figure 31. For FE conducted at Fort Hood, the majority of testing was completed with the two troop commanders. From previous discussion, the project team knew that one troop commander would be modifying existing exercises, and the other

would be creating new exercises. Their test cases were based on this and adapted to their needs. In addition, the team decided to test the O/C, FDC, and CTCP workstation operator functions of the CITT and requested personnel from the squadron appropriate for those tests. Test cases were prepared for the workstation operators which directed the participant to use CITT to obtain and examine all of the information they would need to support the exercise(s) their unit would be using in CCTT. During testing, however, the team learned that the commanders would be observing their own exercises, thus, the O/C case was dropped from the test. The Contractor Logistics Support (CLS) site person was given a very general case—learn about the CITT

The Fort Knox test schedule changed to add additional participants to compensate for participants who were dropped from the Fort Hood schedule. The ARI Research Coordinator contacted and coordinated the scheduling of individuals from Fort Knox who would serve as test participants.

		Learn About CITT	Navigate CITT	Learn About CCTT		Produce Training Materials			Produce Exercise Files	
				IO	TT	Select	Modify	Create	Build	Test
Testing at Ft.Hood										
Troop Commander	R/M/C Ex	.	.	.	.	.	.	.	.	.
Troop Commander	R/M/C Ex	.	.	.	.	.	.	.	.	.
FSE SGT	FABTOC	.	.	.	.	.	.	.	.	.
Mortar PL or PSG	FDC	.	.	.	.	.	.	.	.	.
CLS		.	.	.	.	.	.	.	.	.
Testing at Ft.Knox										
Bn S3/Asst S3	R/M/C Ex	.	.	.	.	.	.	.	.	.
Bn S3	O/C	.	.	.	.	.	.	.	.	.
FSE SGT	FABTOC	.	.	.	.	.	.	.	.	.
Tm mtnc SGT	UMCP	.	.	.	.	.	.	.	.	.
Mortar PL or PSG	FDC	.	.	.	.	.	.	.	.	.
Engineer company XO	CES	.	.	.	.	.	.	.	.	.
S4 NCO or supply SGT	CTCP	.	.	.	.	.	.	.	.	.
Bde Commander		.	.	.	.	.	.	.	.	.
Operations NCO		.	.	.	.	.	.	.	.	.
CLS	Build Ex	.	.	.	.	.	.	.	.	.

Figure 31. The modified FE plan for Fort Hood and Fort Knox.

The project team had learned during informal user testing that two observers were required for each test session, and that at least one of them needed expertise in structured training and TSPs. FE observers were selected who fit these criteria. Since FE at Fort Hood was occurring first, and since two test machines were being used, a total of four observers were required. The project manager, the evaluation specialist, a project team subject matter expert (SME), and an SME from the STRUCCTT-2 team were selected as observers.

Data collection and observation forms were developed for each of the three major testing activities (test CITT, test the build/proof process, and test the exercise execution.)²⁴ Two types of forms were developed for each session. (See Appendix E for examples of all data collection forms.) Observation forms were developed to be used by the observers during the CITT test, during build/proof, and during exercise execution. For the CITT test forms, all of the actions a user could take in the CITT were listed and a scheme for abbreviating them was developed. This facilitated observation. In addition, test assistance guidance was developed which provided options for the observer to assist the participant during testing. Consistent with the directive from the SOW to use passive observation, observers received instruction to provide the minimum assistance necessary. The first option was to suggest the participant try the built-in CITT help. If that failed, observers were told to provide a general hint or assistance such as, "you might want to consider the task steps you want the unit to perform." If assistance was still needed, they were told to provide a direct instruction such as, "Go to Initial Settings and list the task steps you want the unit to perform." Although providing assistance goes beyond passive observation, the project team decided the alternative (allowing the participant to get further and further "lost") would be unacceptable. This approach to providing assistance worked well.

The abbreviation code and the assistance guidance appeared on each left hand page of the observation booklets to be used as an aid to the observer during testing. In addition, interview/debriefing forms were developed for each test session using questions germane to the specific test. These questions appeared on the left hand pages of the recording booklets to facilitate the interviews. In the actual FE, only the CITT Test observation and Interview/debriefing booklets were used.

On 10 September, a familiarization/training session was conducted for the test observers. The purpose of the FE testing was discussed at length, and observation and interview/debriefing procedures were covered.

On 14 September, the first test sessions were conducted with the troop commanders at Fort Hood. The FE plan specified that the commanders would participate in the test for approximately two and a half days and would be interviewed the afternoon of the third day. It was anticipated that both commanders would develop (either by modifying or creating) several exercises. In actuality, this did not occur. One commander participated for a total of 15 hours excluding the interview/debrief. The second commander participated for approximately 10 hours excluding interview/debrief. Both had other duties and responsibilities with their troops which prevented them from participating for the entire day. In fact, one was unable to participate at all on the 16th, however, he did return on the 17th and completed the exercise he had started. Following their test on the CITT, each commander was requested to complete the CITT questionnaire and was then asked to participate in the interview/debriefing which took approximately an hour.

On the 17th, FABTOC and FDC workstation operators were tested. However, the commander who had tasked them to participate, sent the participants in pairs which made

²⁴ Data collection and observation forms were developed prior to the decision that the build/proof and exercise execution components of FE would have to be dropped. Discussion of them is included in the report for completeness.

interpretation of the session somewhat difficult. They were able to complete the test cases, however, post-test debriefing occurred only for one of the pairs. Also on the 17th, the Contractor Logistics Support (CLS) site contractor was tested, although his test case was very general. He was told simply to familiarize himself with CITT.

In general, it is fair to say that, with the exception of a few minor problems and the necessity to adapt to the schedules of the soldiers participating in the test, the FE sessions at Fort Hood went well. However, one additional point should be noted regarding testing at Fort Hood. Although no test participant was asked to use the CITTDT, it was tested by members of the project team and by the TSM. The CITTDT was accessed using a network connection that went through the post local area network (LAN). This was done to determine how it would operate under conditions that represent those typically found on an Army installation. This testing was very informal and observation data were not collected. Essentially, it was a "let's see what happens" test the results of which will be reported below.

FE testing at Fort Knox began on the 21st of September and continued through the 6th of October. The ARI Research Coordinator had arranged a testing schedule that involved one three-hour test session per day and covered all of the test cases shown in Figure 31. A total of 10 participants were tested—eight for one session each and two for two sessions each. The participants tested for two sessions were the Battalion S3 and the CLS contractor. Test cases were prepared in advance for all sessions. One participant received instructions to use the CITTDT; all other test cases involved the CITTSA. (The Brigade Commander was given a very general test case and actually used both versions.)

Sessions were observed by the evaluation specialist and the project team SME who had been an observer at Fort Hood. (The evaluation specialist was unable to observe one session and was replaced by the CITTSA database application developer.) Observations were recorded in the CITT Test Observation Booklets and interview/debriefing results were recorded in the CITT Test Debriefing Booklet. In addition, most participants were requested to complete the CITT questionnaire.

As at Fort Hood, there were no major problems with FE testing at Fort Knox. With one exception, all participants arrived as scheduled, and all sessions were conducted as planned.

Formative evaluation results. Findings from formative evaluation will be described in two categories: findings representing problems/defects or shortcomings in the CITT itself (e.g., coding errors, incorrect links, functions and features not working, etc.), and findings which reflect the test participant's reactions to the CITT in terms of usability, appearance, user interface, etc.

Following the completion of all test cases, the observers met to analyze the test results. The initial analysis involved reviewing all of the observation data to determine problems/defects or shortcomings in the CITT. This analysis resulted in two lists of defects: those to be corrected in the prototype and those to be assigned to future updates/functionalities. A list of 29 prototype defects or shortcomings was identified and is included as Appendix F—CITT Improvements Implemented. This list was given to the project team developers and was used to refine the CITT prototype. A second list of defects/enhancements or shortcomings, consisting of 33 items, was

identified from the FE data and is included in Appendix G—CITT Improvements To Be Implemented. This list represents desired functionalities for a future CITT that were not implemented in the prototype. Some of these desired functionalities are included in the CITT design, i.e., they were considered when CITT was designed but were unable to be implemented in the prototype. Others represent modifications and enhancements to the design.

The FE data were also analyzed for user reactions to the CITT using survey data collected from the CITT questionnaire and data from the interview/debriefing sessions. Survey data were analyzed quantitatively and qualitatively; the remaining data were analyzed qualitatively because they were actually more like individual case studies rather than group data. There were relatively few participants (only 10 from whom data were collected individually). And, each participant was tested using a unique test case. This meant that each participant was completing a different set of activities, albeit with a great deal of commonality. This greatly limits the generalizability of the data collected.

Fifteen participants completed the questionnaire.²⁵ Nine participants rated themselves as very or moderately experienced with using personal computers. In response to "How well were you able to accomplish what you wanted to do?" over half (8) of the participants said well or very well. Six participants said they were able to accomplish what they want to a fair amount, and one said not at all. When asked how difficult it is to navigate through the CITT, 12 participants responded either very easy or easy. No participant thought it was extremely difficult. Thirteen participants thought navigation tools and buttons were used consistently or very consistently throughout the CITT, and 11 indicated that it was easy or very easy to get back to where they wanted to be if they became "lost".

Ten of the participants indicated that they had used the help feature of the CITT during their session, the majority of them had used help ten times or less. One participant had used help more than 20 times. Of these 10 participants, eight said the built-in Help material were either very helpful or somewhat helpful. Seven participants thought the Help material was written at the correct level, and only one participant said he or she was unable to obtain Help when they needed it. In explanation, that participant said he could not obtain help at the start of the session.

In response to "What feature of the CITT did you find most useful?" a variety of responses appeared. Two participants mentioned the linkages that are built into the CITT. Other items mentioned included the Matrix OPORD, the Audio feature, the mission layouts and thumbnails, the help fields, and the graphic software. In response to the least useful features item, again a variety of responses appeared including filling in SAF for BLUFOR units, the Access database and TSP approach, structured training, buttons not working, the problem of marking an exercise complete and then later wanting to change it, and the need to have the graphic display files change as the terrain associated with the graphic overlays changes. Caution

²⁵ The apparent discrepancy between 15 participants completing the questionnaire and 12 participants from whom data were collected individually is easily explained. One participant who participated in more than one test session completed the questionnaire more than once. Also, four of the workstation operators who had tested at Fort Hood in pairs each completed the questionnaire individually. Two of the Fort Knox participants did not complete the questionnaire.

should be exercised in interpreting these results, however, since, for the most part, they represent the response of a single participant.

When asked what features the participants would like to see added to the CITT, only eight participants responded and there was no consistency among responses. Responses included adding scanning in graphics and the ability to click on a map and have the system automatically assign locations, removing the wizard, the ability to print selected parts of the TSP, crew level training, step-by-step instructions, and adding a password option to allow access to an exercise even after it had been marked complete.

Interview/debriefing data showed the same wide range of responses that survey data did and generally support the survey data. Generally speaking, overall reaction to the CITT was very positive. Only one participant was unable to complete the test case which, in itself, is a very positive indication of the system's usability. CITT is a relatively complex system and the fact that almost all participants were able to use it satisfactorily on their first attempt is significant.

In general, all participants had an overall positive impression of the CITT. They thought it was relatively easy to use and relatively easy to navigate. A number mentioned the different ways to navigate as a plus. The Wizard Agent was probably the only feature that was viewed with ambiguity. Participants either liked it a lot or thought it was a nuisance. The IO was mentioned several times as a positive feature; participants generally liked the tree-view feature. Several also mentioned the audio-visuals that are included in the IO.

Some representative comments from the interview/debriefing session are shown in Table 3.

Table 3. Comments from interview/debriefing

This is far more than I expected from an Army Program. (Said of the CITTSA)
As far as Army Web sites, it was great. (Said of the CITTDT)
The CITT has the potential for all types of training, not just for CCTT.
Good system, user friendly, but time consuming.
It is a complex process with levels within levels. This is sometimes confusing.
It is easy to miss the Tabs.
I was able to find everything I needed; it's relatively complete.
You need a way to keep track of where you are.
Need to make the process of finding an exercise simpler.
It needs a tutorial on using a Windows environment.
Unit commanders won't have time to use CITT.

As Table 3 indicates, the CITT was successful in achieving the objectives specified; however, considerable room for improvement still remains.

Finally, a word about the results of the informal test of the CITTDT from Fort Hood using the post LAN. Because every user has direct access to the Internet rather than going through a proxy server, traffic becomes very heavy during normal working hours. It was not

uncommon for a page to require 4-5 minutes to load, and some pages required as much as 10 minutes. This is deemed unacceptable for typical users.

LESSONS LEARNED

The CITT Project represents a "first approach" to providing soldiers with a viable training support package (TSP) generator and information system using a state-of-the-art simulation system. Throughout the project, a number of lessons were learned from this effort that will be instrumental in future endeavors involving systems of this nature. This section describes lessons learned for the project in general and for design and prototype development and testing.

General

As the project team was designing CITT, and particularly while developing the prototype, the team realized that many of the tasks that can be simulated in the CCTT cannot actually be executed realistically, and thus have unknown value as far as how well the training will transfer to actual task performance. It is imperative, therefore, that the Army define task performance support codes (TPSCs) for all MTPs and all simulations. Given the limited training time available to units, and as they rely more and more on virtual training environments, it becomes particularly important that the units concentrate on those tasks which have the greatest transference. The unit in the field is being misled and can waste valuable time and energy on designing training for tasks that can not be executed on the selected simulation.

The Army must examine/determine the TSP components and formats needed to support training at all echelons and for all environments (virtual, constructive, and live). Currently, SATS provides a template for TSPs, however it is too generic to apply to all of the training situations discussed in the fielding plan. The SATS TSP components can serve as the core requirements, however, additional components necessary to support the different types of training and exercises envisioned need to be identified. This is especially important if an attempt is made to develop a "master" training data base as envisioned in the fielding plan that will support training at all echelons and in all environments. One way to identify all of the elements and relationships needed in this database is by examining the TSP components needed for different types of training/exercises and reverse engineering the database requirements from them.

CITT Design

It is extremely important in modeling to identify the point of view (POV) from which modeling is being completed and to model from that perspective. This may sound obvious, but in point of fact, is often quite difficult to accomplish. In the CITT Project, for example, even though the initial POV for modeling was the Commander/Unit Trainer, the project team often slipped into modeling from the standpoint of the capabilities of the simulator or from the structure and format of the TSP. This resulted from the designers' familiarity with and knowledge about the CCTT and the TSP format developed for the STRUCCTT projects, and it was sometimes easy to think in those terms. Modeling from the POV of the Commander/Unit

Trainer required a conscious decision-making process that continuously asked "what will the user be doing with this?" As modeling is completed for other users, the same decision-making process is required.

The project team underestimated the time required to learn to do modeling. Even though there are numerous references and standards that describe the modeling process, there is still a substantial learning curve. The process itself is complex. Future projects must either allow adequate time to learn to model or should make sure that at least one member of the project team has the requisite modeling skills.

The CITT design, particularly the initial modeling efforts, proved to be difficult because of problems the team had separating design from prototype development. Modeling frequently became bogged down with discussions of whether the prototype development software would work a certain way, or whether a given activity would be able to be implemented in the distributed version, etc. This was true even though the team understood and agreed that the primary goal of the project was to design a CITT, not to develop a prototype. The difficulty is that modeling is a very abstract process while prototype design and development are very concrete, and it is easy for the concrete to overwhelm the abstract. The solution was to develop a design and modeling process that clearly separated CITT design from prototype development. The process consisted of the following basic steps: an activity was identified and defined, and the ICOM for it was produced. During this process, no discussion was allowed regarding how the activity would be implemented in the prototype. Thus modeling was completed in the framework of how the CITT could best achieve a particular user's needs. Only after an activity had been designed and modeled was discussion opened to implementation in the prototype. At that point, the team considered the implications for the prototype database definitions and design, followed by implication for the user interface (i.e., how the application screens would function with the database), and by implications for the help files.

There was a terminology problem that had to be overcome before modeling could proceed successfully. In the STRUCCTT projects, TSP had been used to indicate a set of exercises that supported a specific mission (e.g., movement to contact, defense in sector, etc.), and individual exercises were referred to as Tables. In reviewing other Army training systems, particularly SATS, it was apparent that TSP was used differently. Specifically, the TSP applied to an individual exercise. This discrepancy caused initial difficulty especially for modeling. The solution was to agree on and document a consistent terminology wherein TSP was used to refer to the materials which support a specific exercise as was employed in SATS. What had been referred to as a TSP in the STRUCCTT projects would be referred to as an exercise mission set. Once terminological inconsistencies were resolved, modeling proceeded more smoothly. From a broader perspective, however, this issue will require resolution before integration among all of the various Army training systems will be achieved.

Prototype Development and Test

The decision to make the CITTSA and CITTDT versions appear alike created difficulties. The decision was based on a consideration of appearance versus function and on the idea that by making the versions look alike, users would have less difficulty using two versions. However, the development of the prototype versions, particularly the distributed, was more difficult

because of this. Additional time and programming were required to make the distributed version look like the standalone when all that was actually required was for the two versions to function the same.

It is possible for prototype development to start significantly before design has reached 80%. Although the Research Plan specified 80%, prototype development actually began much earlier, and while the present project did not assess the impact of this, it did demonstrate that it is possible. Perhaps future projects can assess the relative risks and benefits of beginning prototype development at various stages of design.

Working with an off-site developer to supply a major piece of the CITTDt created difficulties. This was most likely due to less frequent communication between the on-site and off-site developers. The difficulties were not alleviated until a member of the on-site staff was assigned to work directly with the off-site developers, and a member of the off-site developer's staff started working on-site more often. Future projects that use off-site personnel to complete portions of the project need to consider how to establish and maintain close communication and oversight.

Test results for the CITTDt were very dependent on what time of day the test was conducted and how congested the actual connection from the Internet Service Provider (ISP) was. For military posts the typical user's connection is through the post LAN with each user having his or her own Internet Protocol address. This led to heavy congestion, particularly between mid-morning and mid-afternoon, and a degradation of system performance. For a system such as the CITTDt to operate efficiently, it needs to be accessible through a fast connection such as a proxy server.

SUMMARY

This report has described the activities and outcomes of a project to develop the Commanders' Integrated Training Tool for the Close Combat Tactical Trainer. The CITT will provide commanders and other unit trainers with the capability to develop structured training exercises for use in the CCTT virtual trainer including the ability to select existing training exercises that match their unit's needs, and if no such exercises exist, to modify existing exercises or create new ones. To maximize training effectiveness, CITT supports a process for exercise modification or creation in accordance with the principles of structured training.

The primary product of the project was the design of the CITT which was completed and documented in accordance with industry accepted modeling procedures and standards. Extensive effort was also directed at identifying and organizing information on CCTT, the structured training process, and exercise development which comprised the IO and was included in the CITT design. The IO served as the basis for the development of two videotapes for CCTT—one for brigade commanders and above, and one for brigade commanders and below. It also served as the basis for the Learn About CCTT module of a CITT prototype which was developed as a proof of principle of the CITT design. The prototype CITT was produced in two versions, a standalone version and a distributed version, although the standalone version had

greater functionality. Formative evaluation of the prototype was conducted at Fort Hood and Fort Knox using test cases designed to exercise all of the CITT functionalities with a variety of users.

The FE results were analyzed to determine defects or problems with the CITT and areas where CITT could be improved. Two levels of results were obtained: those which were implemented in the CITT during the project in order to produce the refined CITT prototype, and those which were recommended for future CITT development. Based on FE and data captured during the project, lessons learned were derived and presented.

Finally, an implementation and fielding plan for the CITT was developed and presented for both a near- and long-term solution. The near-term plan provides for fielding the CITT as a standalone system while the long-term plan provides for integrating CITT into a broader-based Army Training System such as SATS.

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APPENDIX A

ACRONYMS

AAR	After-Action Review
ADTDL	Army Doctrine and Training Digital Library
APC	Armored Personnel Carrier
ARI	Army Research Institute
ARI AFRU	ARI Armored Forces Research Unit
ARTEP	Army Training and Evaluation Plan
ASAT	Automated Systems Approach to Training
AT XXI	Army Training XXI
ATIMP	Army Training Information Management Program
ATSC	Army Training Support Center
BLUFOR	Blue (Friendly) Forces
BOS	Battlefield Operating System
CATS	Combined Arms Training Strategy
CATT	Combined Arms Tactical Trainer
CBT	Computer-based Training
CCTT	Close Combat Tactical Trainer
CCTT-D	Close Combat Tactical Trainer - Digital
CES	Combat Engineer Support
CGF	Computer Generated Forces
CIS	Combat Instruction Set
CITT	Commanders' Integrated Training Tool
CITTDI	CITT Distributed
CITISA	CITT Standalone
CLS	Contractor Logistics Support
COR	Contracting Officer's Representative
COTS	Commercial-off-the-shelf
CSS	Combat Service Support
CTCP	Combat Trains Command Post
DA	Department of the Army
DDE	Dynamic Data Exchange
DIM	Dismounted Infantry Module
DIS	Distributed Interactive Simulation
DoD	Department of Defense
DOIM	Directorate of Information Management
EDUCCATT	Education of CCTT through Computer Assisted Training Technology
EIA	Electronics Industries Association

FABTOC	Field Artillery Battalion Tactical Operations Center
FDC	Fire Direction Center
FE	Formative Evaluation
FEO	For Exposition Only
FIST-V	Fire Support Team Vehicle
GCM	Graphic Control Measure
GIF	Graphic Interchange Format
GUI	Graphical User Interface
HHQ	Higher Headquarters
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HTML	Hypertext Markup Language
HumRRO	Human Resources Research Organization
ICAM	Integrated Computer-Aided Manufacturing
ICOM	Inputs, Controls, Outputs, and Mechanisms
IDEF	Integration Definition for Function Modeling
IEEE	Institute of Electrical and Electronics Engineers
IO	Instructional Overview
IPR	In-process Review
ISD	Instructional Systems Design
ISP	Internet Service Provider
LAN	Local Area Network
MC	Maintenance Console
MCC	Master Control Console
METL	Mission Essential Task List
METT-T	Mission, Enemy, Troops, Terrain, and Time Available
MIS	Management Information System
MTP	Mission Training Plan
O/C	Observer/Controller
OPFOR	Opposing Forces
PM	Project Manager
PM CATT	Project Manager for the Combined Arms Tactical Trainer
POC	Point of Contact
POV	Point of View
SAF	Semi-Automated Forces
SAT	Systems Approach to Training
SATS	Standard Army Training System
SIMNET	Simulation Networking

SME	Subject Matter Expert
SOW	Statement of Work
SQAP	Software Quality Assurance Plan
STRICOM	Simulation, Training, and Instrumentation Command
STRUCCTT	Structured Training for Units in the Close Combat Tactical Trainer
STX	Situational Training Exercise
SUIP	Simple User Interface Prototype
TACP	Tactical Air Control Party
TEXMIS	Training Module (TRAMOD) Executive Management Information System
TOC	Tactical Operations Center
TPSC	Task Performance Support Code
TRADOC	Training and Doctrine Command
TRAMOD	Training Module
TSM	TRADOC System Manager
TSP	Training Support Package
UIP	User Interface Prototype
UISG	User Interface Style Guide
UMCP	Unit Maintenance Collection Point
VTP	Virtual Training Program
WOG	Workstation Operators Guide

APPENDIX B
"TO-BE" NODE TREE

USED AT:	AUTHOR: CITT Team PROJECT: CITT	DATE: 10/30/98 REV: 10/30/98	WORKING DRAFT RECOMMENDED PUBLICATION	READER	DATE	CONTEXT: <div style="text-align: center; font-size: 24pt; font-weight: bold;">TOP</div>
NOTES: 1 2 3 4 5 6 7 8 9 10		A-0				

Use the
Commanders'
Integrated Training
Tool

Examine CITT
A1

- ☐ Learn about CITT
- ☐ Learn about Navigating in CITT

Learn about CCTT
A2

- ☐ Explore CCTT
- ☐ Examine System Capabilities
- ☐ Examine Training Capabilities
- ☐ Learn about Structured Training
- ☐ Learn about the Training Process
- ☐ Learn about CCTT Exercises

Produce Training Materials
A3

- ☐ Select an Exercise
- ☐ View the Exercise
- ☐ Develop an Exercise

Produce Exercise Files
A4

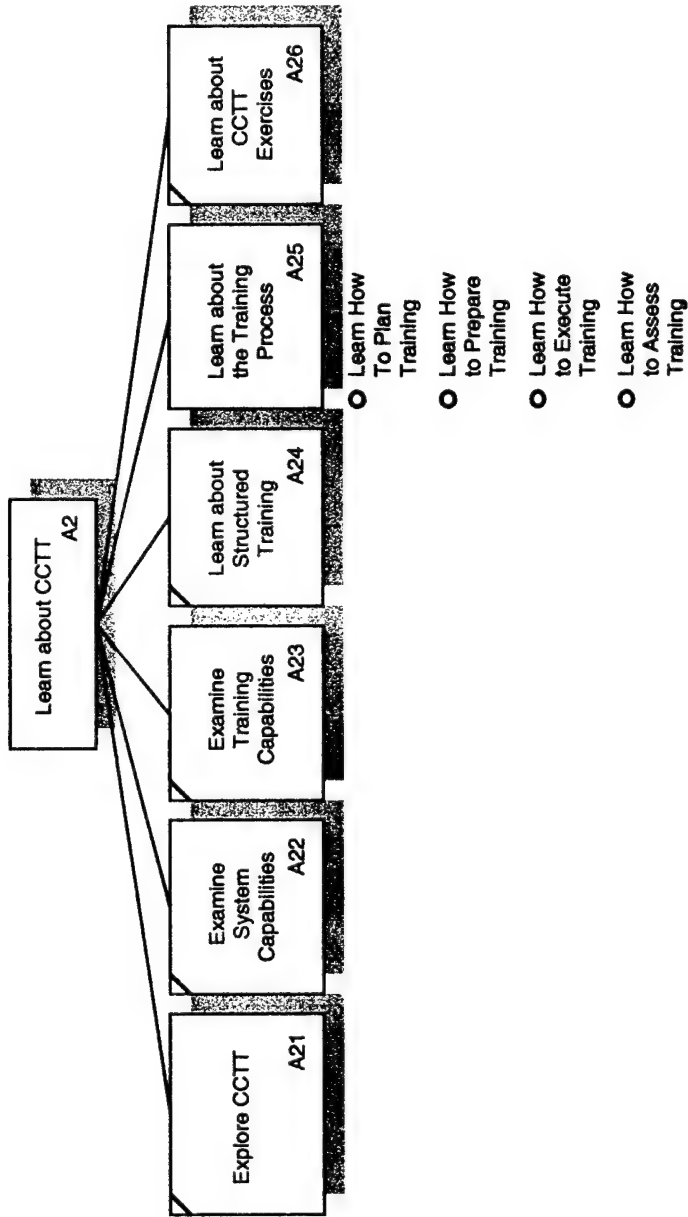
- ☐ Build an Exercise File
- ☐ Proof an Exercise

Execute Support Functions
A5

- ☐ Coordinate with Site
- ☐ Schedule the Site
- ☐ Provide Feedback

NODE: A0	TITLE: Use the Commanders' Integrated Training Tool	NUMBER:
----------	---	---------

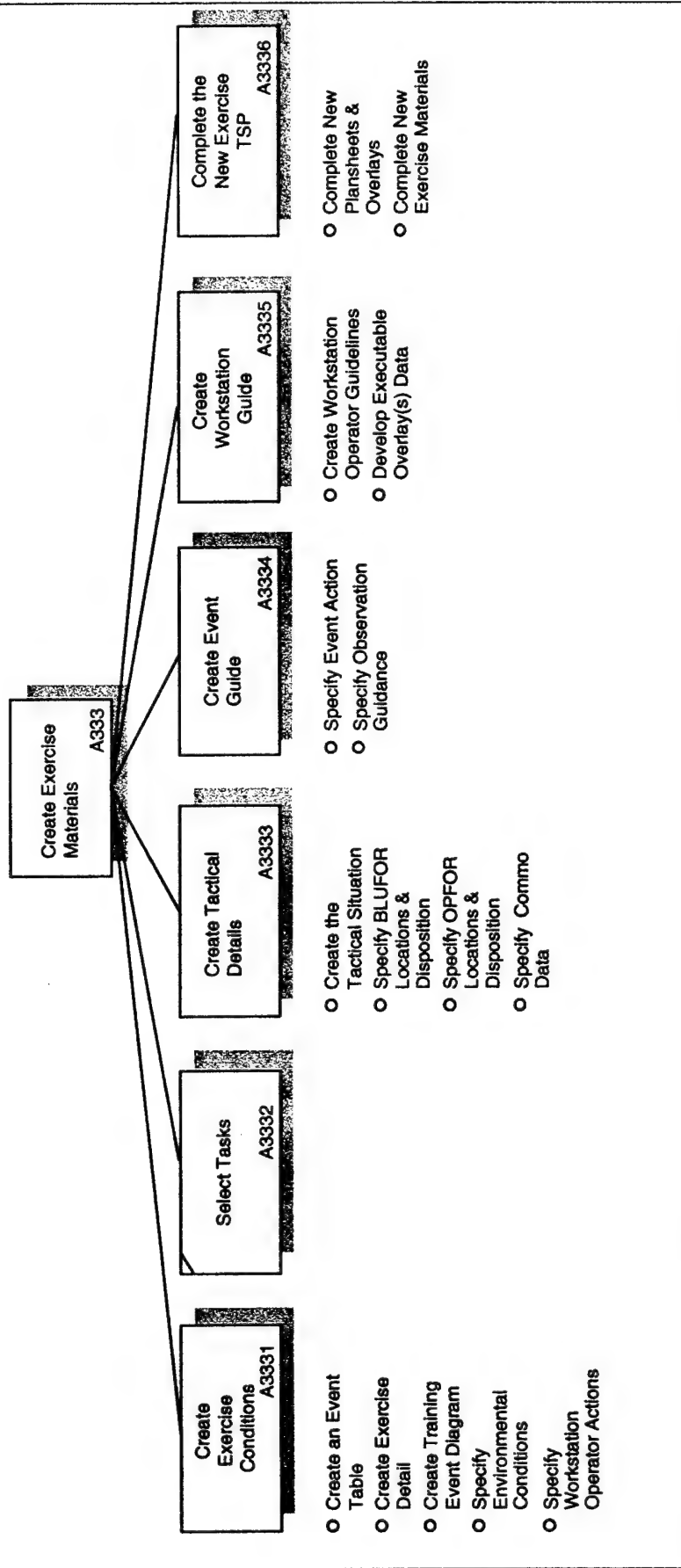
USED AT:	AUTHOR: CITT Team PROJECT: CITT	DATE: 10/30/98 REV: 10/30/98	WORKING DRAFT RECOMMENDED PUBLICATION	READER	DATE	CONTEXT: TOP A0
NOTES: 1 2 3 4 5 6 7 8 9 10						



NODE: A2	TITLE: Learn about CCTT	NUMBER:
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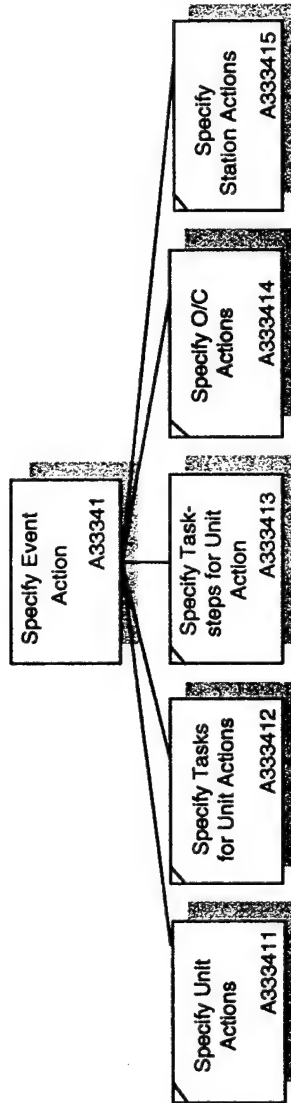
USED AT:	AUTHOR: CITT Team	DATE: 10/30/98	WORKING	READER	DATE	CONTEXT:
	PROJECT: CITT	REV: 10/30/98	DRAFT			TOP
			RECOMMENDED			
			PUBLICATION				A0
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Produce Training Materials A3 </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Select an Exercise A31 </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> View the Exercise A32 </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Develop an Exercise A33 </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="width: 30%;"> <ul style="list-style-type: none"> <input type="radio"/> Select Exercise Sort Criteria <input type="radio"/> Evaluate a CCTT Exercise </div> <div style="width: 30%;"> <ul style="list-style-type: none"> <input type="radio"/> Define Mission Set Parameters <input type="radio"/> Define Exercise Outline <input type="radio"/> Create Exercise Materials </div> </div>						
NODE: A3		TITLE: Produce Training Materials			NUMBER:	

USED AT:	AUTHOR: CITT Team	DATE: 11/3/98	WORKING	READER	DATE	CONTEXT:
	PROJECT: CITT	REV: 11/3/98	DRAFT			<input type="checkbox"/>
			RECOMMENDED			<input type="checkbox"/>
NOTES: 1 2 3 4 5 6 7 8 9 10			PUBLICATION			A33



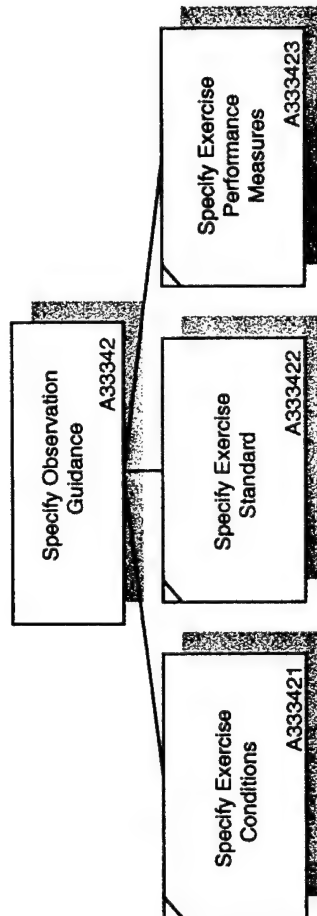
NODE: A333	TITLE: Create Exercise Materials	NUMBER:
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USED AT:	AUTHOR: CITT Team	DATE: 11/3/98	WORKING	READER	DATE	CONTEXT:
	PROJECT: CITT	REV: 11/3/98	DRAFT			■
			RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10		PUBLICATION			A3334



NODE: A33341	TITLE: Specify Event Action	NUMBER:
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USED AT:	AUTHOR: CITT Team/Dannemiller	DATE: 12/7/98	WORKING	READER	DATE	CONTEXT:
	PROJECT: CITT Design	REV: 11/30/98	DRAFT			<input type="checkbox"/>
	NOTES: 1 2 3 4 5 6 7 8 9 10		RECOMMENDED			
			PUBLICATION			A3334



NODE: A33342	TITLE: Specify Observation Guidance	NUMBER:
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USED AT:	AUTHOR: CITT Team PROJECT: CITT	DATE: 10/30/98	WORKING	READER	DATE	CONTEXT:
		REV: 10/30/98				
NOTES: 1 2 3 4 5 6 7 8 9 10						TOP
<div style="text-align: center;"> <pre> graph TD A4[Produce Exercise Files A4] --- A41[Build an Exercise File A41] A4 --- A42[Proof an Exercise A42] A4 --- A43[Assemble Exercise Materials A43] </pre> </div>						
NODE: A4	TITLE: Produce Exercise Files					NUMBER:

USED AT:	AUTHOR: CITT Team PROJECT: CITT	DATE: 10/30/98 REV: 10/30/98	WORKING	READER	DATE	CONTEXT:
			DRAFT			TOP
			RECOMMENDED			
			PUBLICATION		A0	

Execute Support Functions
A5

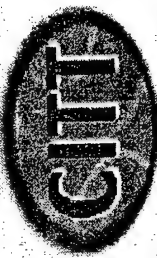
Coordinate with Site
A51

Schedule the Site
A52

Provide Feedback
A53

NODE: A5	TITLE: Execute Support Functions	NUMBER:
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APPENDIX C
SCREEN SHOTS FROM
THE CIT TSA



Commanders' Integrated Training Tool for the Close Combat Tactical Trainer

CITT Audio Tour

Welcome to CITT.

CITT is a fully integrated training and training management system that supports all features of unit training in the Close Combat Tactical Trainer. It includes exercise selection and development, extensive supporting information and help, navigation aids, and exercise management functions for a variety of users.

- For Unit Commanders/Leaders, it provides a tool for selecting exercises for training in CCTT that match the unit's current training needs. If no existing exercise adequately supports the unit's training needs, CITT also provides tools for modifying existing exercises or for creating new exercises that do satisfy the needs.
- For CCTT exercise Observer/Controllers, it provides information on all O/C functions involved in CCTT training as well as information on conducting the After Action Reviews which are critical to successful structured training. In addition, CITT provides the O/C access to all materials necessary to direct the unit as they prepare for and execute training in the CCTT.
- For other workstation operators (e.g., Combat Engineering Support, Field Artillery Battalion Tactical Operation Center, etc.), it provides information on workstation operation and use as well as the specific information needed by each workstation operator to support the unit's training on specific exercises.
- For CCTT Site Staff, it provides the materials required to build exercises and manage exercise execution.
- For anyone interested in learning about the Close Combat Tactical Trainer, Structured Training Principles, and the application of structured training principles to CCTT exercise development, it provides extensive information on each of these topics.

CITT Admin Only

CITT Overview

How To
Navigate CITT

Learn About
CCTT

Produce
Training
Materials

Produce
Exercise Files

Exercise
Management
Tools

Exit CITT

This is the opening screen of CITT. It provides the user with an overview of the CITT system and access to CITT's major components.

CITT Overview

How To Navigate CITT

Learn About CCTT

Produce Training Materials

Produce Exercise Files

Exercise Management Tools

Produce Training Materials

Orientation Exercises

Review Exercise

Situational Training Exercises (STX)

Select An Exercise

Review Exercise

Modify Exercise

Create Exercise

Platoon Gunnery Exercises (GTX)

Review Exercise

Command Field Exercises (CFX)

Review Exercise

Tactical Exercise Without Troops (TEWT)

Review Exercise

Other Types

Review Exercise

Review CCTT Training Approach

CITT Training Materials provides users 'how to' instruction on preparing and using structured training support packages (TSP) based on a structured simulation-based methodology. It provides information for reviewing the training approach within CCTT, and how to select, modify, or create a CCTT exercise.

Select an Exercise allows users to designate basic exercise requirements, view the available exercise data, and make decisions based upon the listing of exercises.

Modify an Exercise provides the user with information on how to modify an existing structured exercise using a previously selected exercise as the foundation. It provides guidance that reinforces the structured simulation-based approach to developing training for CCTT. Modify an Exercise can only be used after selecting an exercise.

Create an Exercise provides the user a step by step process for creating a structured exercise using a structured exercise template as a foundation. It provides guidance that reinforces the structured simulation-based approach to developing training for CCTT.

Post Exercise Report

The Produce Training Materials screen provides access to the "how to" instruction on preparing and using structured training support packages, as well as the ability to select, review, or create a new exercise.

The Select by Task screen assists the user in narrowing down the selection of TSPs by entering specific task requirements. Further, it provides access to the Select by Name and Select by Criteria screens.

This is a results screen for the Select by Task screen. It displays all the TSPs meeting the specified requirements.

Modify An Existing CCTT Exercise

How To Modify An Exercise

Begin Modify

Complete Modifications

Print Materials

Review Exercise

Modify Exercise

Create Exercise

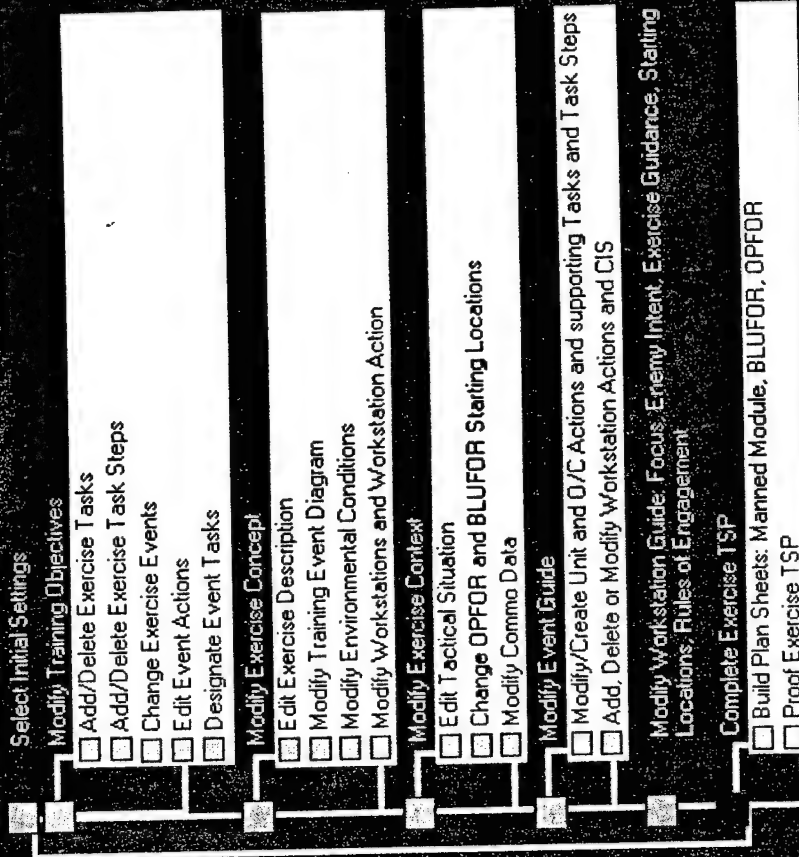
Close Modify

CITT Exercise Id: PAMV3-2CCS ☒ Complete

Modify Steps

These are the steps to modifying an exercise. After you click the "Begin Modify" button, CITT will copy your selected exercise and allow you to make changes to editable components. Copying an exercise will take a few moments. Your mouse pointer will appear as an hourglass while the record is being copied. After the copy operation is complete, CITT will take you to the first step in the modification process: "Select Initial Settings."

Print Modify Steps



The Modify An existing CCTT Exercise screen is the first screen in the modification process. It outlines all the steps involved in the modification of an existing TSP.

Print Materials

Name:

Develop the Situation

Exercise Focus:

During daylight conditions, this table focuses on tactical movement, actions on contact, and attack by fire.

Allowed Changes

Unit:

A

Sequence:

3

Mode:

C

Type:

S

Fixed Settings

Echelon:

P

Mission:

MV

Terrain:

2

Difficulty:

X

Author Code

Unknown Author

Date Changed:

12/10/98

Open Set Mission Summary

☐ Select Initial Settings
 ☐ Modify Training Objectives
 ☐ Modify Exercise Concept
 ☐ Modify Exercise Context
 ☐ Modify Event Guide
 ☐ Modify Workstation Guidelines
 ☒ Complete Modified Exercise

Close

Modify

Next

Modify Matrix OPORD

OPORD CCT-ARPL-MTC-02-001-DY

SITUATION: A. ENEMY: The enemy will most likely to secure the high ground via our OBJ CHEVY with HANCOCK in order to attack the flank or rear of our

Exercise Performance Note

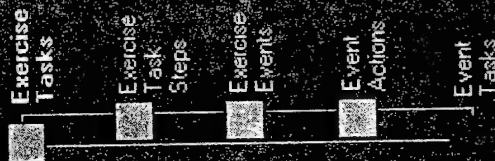
The Select Initial Settings screen allows the user to establish the initial exercise parameters. This screen also provides access to the Matrix OPORD and exercise overlay.

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CITT Exercise Id: PAMV3-2XCS

Exercises are composed of Events which are geared to train Tasks. On this screen you have the option of adding, deleting or modifying Events, Tasks and Task Steps

Event-Task Wizard



Task Number	Task Name
17-3-0219	CONDUCT AN ATTACK BY FIRE
17-3-0221	EXECUTE ACTIONS ON CONTACT
17-3-1016	CONDUCT TACTICAL MOVEMENT
17-3-DRL-3	ACTION DRILL
17-3-DRL-4	REACT TO INDIRECT FIRE DRILL
*	

Record: [] of 5

<Previous

Next

The Modify Training Objectives screen provides the user the ARTEP MTP task that will be the focus of the exercise.

CITT Exercise Id: PAMV3-2XCS

Modify Exercise Concept

Modify Exercise Description

Modify Training Event Diagram

Modify Environment

Modify Workstations

Task Focus

During daylight conditions, this table focuses on tactical movement, actions on contact, and attack by fire.

Concept of Exercise

Having previously engaged and destroyed enemy air reconnaissance elements and the CRP, the platoon continues its movement as the lead platoon of the lead team in the task force movement to contact. Acting as the unit commander, the O/C directs the platoon as it reacts to indirect fire, then executes actions on contact when it encounters the FSE. 1/A/1-34 AR is the lead platoon for Tm A/TF FALCON. Tm A is in a wedge formation as the lead element for TF FALCON. During the tank platoon movement to contact tables, 1/A/1-34 AR maneuvers as part of its parent team. 2/A/1-34 AR maneuvers on the right rear flank of 1st Platoon and 3/C/1-16 IN is on the left rear flank. In addition to the other elements of Tm A, supporting units such as air defense, artillery, and mortars provide support to Tm A.

Select Initial Settings

Modify Training Objectives

Modify Exercise Concept

Modify Exercise Context

Modify Event Guide

Modify Workstation Guidelines

Complete Modified Exercise

<Previous

Next>

The Modify Exercise Concept screen allows the user to modify the task focus and the concept of the exercise. It also provides access to the Training Event Diagram that illustrates the exercise graphic control measures and terrain features, the Environmental Conditions, and Workstations.

Exercise Context - Modify

Modify Tactical Situation

Modify Starting Locations

Modify Commo Data

CITT Exercise Id: PAMV3-2XCS

Matrix OPORD

Select Initial Settings

Modify Training Objectives

Modify Exercise Concept

Modify Exercise Context

Modify Event Guide

Modify Workstation Guidelines

Complete Modified Exercise

<Previous

Next>

Team Alpha is conducting a movement to contact along AXIS W/EASEL to defeat forces in zone and secure QBJ CHEVY.

The team is in a wedge formation. Your platoon is at a temporary halt vic NK480135. The platoon is currently configured in a wedge formation, waiting for the order to move. You are the lead platoon for the team. 2nd Platoon is on the right rear, and 3rd Platoon (MECH) is on the left rear.

The platoon previously encountered a platoon of BMPs thought to be the CRP. The TF commander anticipates making contact with the FSE vic PL PHOENIX. Time now is 1020.

The Modify Exercise Context screen allows the user to Modify the Tactical Situation. This provides the context for the exercise for the training unit. Further, it allows users to modify the OPFOR SAF, Manned Modules, and BLUEFOR SAF starting vehicle locations and communication information necessary to run the exercise.

Exercise Event Guide - Modify			
One action at a time can be shown. Use the record navigation buttons at the bottom of the screen to proceed through the event's actions.			
Event 1: Plt moves tactically Action 1		CITT Exercise Id: PAMV3 - 2XCS Add, Delete or Resequence Actions	
Q/C Action: "Red 1, this is Black 6. Move out. Orient on CP 5, CP 39 to CP 9. Report crossing all phase lines and CP's. Your move is covered." NOTE: Direct OPFOR to move when the Training Unit begins movement. "Red 1, this is Black 6. Roger." NOTE: If plt ldr does not report crossing CP's within 1 minute of crossing call for		Unit Action: Plt moves out in wedge formation. Reports CP 55 and PL PORTLAND. Plt crosses and reports CP 2.	
ARTEP Task/Task Steps 17-3-1016 CONDUCT TACTICAL MOVEMENT 4a [036] As ordered, employs travelling technique of movement. 5c [042] Executes wedge formation.		Workstation Action BLUFOR 2nd and 3rd Plts execute Traveling CIS along RT 2 and RT 3 remaining 750 meters to the rear of 1st Plt OPFOR Start OPFOR FSE Traveling CIS from CP 14 to CP 40 on RT RED when the training unit begins movement. FDC Mortars follow Tm A by 2Kms, along RT M. OPFOR Once FSE is moving, have ntr btry execute Movement.	
Observation Guidance:		Record: 14 1 1 of 1 Modify Training Objectives	
		<Previous Next>	

The Exercise Event Guide Modification screen allows the user to tie all of the modification steps together. This screen illustrates the events in a sequential order and highlights the actions the O/C, the unit, and the workstation operators are expected to execute and the tasks and task steps associated with the event.

Workstation Execution Guidelines - Modify

OPFOR | BLUFOR | FABTOC | FDC

Overview	As the workstation operator, you will need the following information to support the execution of this exercise.
Focus	This table requires an OPFOR consisting of an MIC reinforced with a T80 tank platoon, an antitank squad, a mortar platoon, an ARTY BTRY and an air defense section. The intent is for the OPFOR ground force to be traveling in a tactical formation acting as the Forward Security Element (FSE) of the Advanced Guard Main Body (AGMB).
Enemy intent	The intent of the 269th MIBr is to attack to secure their intermediate objective that consist of the high ground and passes in and around OBJ CHEVY. Their subsequent objective is the entrance to Red Lake Pass, vic NK5910.
Exercise guidance	At the start of the table, the OPFOR FSE is located at CP 14 in a column formation with the T80 platoon leading, the BMP Plts following and the rest of the FSE following them. At the direction of the D/C you will execute the OPFOR company Traveling CIS. Your artillery battery will Occupy Firing Position at NK339111 and will be prepared to Conduct Unobserved Fire Engagement at the direction of the D/C. Your Mortar Battery will Occupy Firing Position at NK380111 and will be prepared to Conduct Unobserved Fire Engagement at the direction of the D/C. When contact is made with the BLUFOR, execute the Occupy Temporary Defensive Position at NK405114 if the D/C directs. When three vehicles from the MIC are lost, execute the Withdrawal Disengagement CIS to CP 14. The graphics to support these CIS are found on the PAM3-D_OPFOR overlay.
Rules of engagement	The OPFOR should exert as much pressure on the training platoon as possible without rendering it combat ineffective. When the MIC loses three vehicles, it should be withdrawn to CP 14. The MIC should not be maneuvered into the high ground to south of AXIS WEASEL where the training platoon will not be able to attack without using dismounted infantry.

<Previous Next>

The Workstation Execution Guidelines Modification screen allows the user to develop guidelines for each workstation used in an exercise.

Complete Modified Exercise TSP

CITT Exercise Id: PAMV3-2XCS

Name: Develop the Situation

Exercise Difficulty: X

Sequence: 3

Plan Sheets

Exercise TSP

When you press the "NEXT>" button at the bottom of this form you will be taken to the Plan Sheets where you can make modifications.

The "NEXT>" button at the bottom of the Modify Plan Sheets form will take you to a form that allows you to view and edit any existing component of the exercise TSP in a format similar to a Word document. If you wish to return to your exercise at a later date and make small, editorial changes, leave the "Complete" box unchecked and use the "Complete Modifications" button from the Modify an Existing CCTT Exercise form to return (Note: If the "Complete" box is checked, the "Complete Modifications" button will be disabled.).

Open Change Summary Form

Exercise Change Note:

Change Date: 12/10/98 Today

Select Initial Settings

Modify Training Objectives

Modify Exercise Concept

Modify Exercise Context

Modify Event Guide

Modify Workstation Guidelines

Complete Modified Exercise

Complete

Exercise Performance Note:

Validation By:

<Previous

Next>

Close

The Complete Modified Exercise TSP screen provides the user the ability to cross-check and verify all the changes that have been made to the exercise.

C-13

Exercise Management Tools

Select An Exercise

ID Name	Echelon, Unit and Mission (EUM)	Exercise Focus	Author Code	Complete
PADF1-2CCS	Tank Platoon Defend	Prepare For Defense	STRUCCTT-2	<input checked="" type="checkbox"/>
PADF3-2CCS	Tank Platoon Defend	Defense of Subsequent BP	STRUCCTT-2	<input checked="" type="checkbox"/>
PAFN1-2CCS	Tank Platoon Fundamentals	Tactical Movement	STRUCCTT-2	<input checked="" type="checkbox"/>
PAFN3-2CCS	Tank Platoon Fundamentals	Defense	STRUCCTT-2	<input checked="" type="checkbox"/>
PAMV2-2CCS	Tank Platoon Move	First Contact	STRUCCTT-2	<input checked="" type="checkbox"/>
PAMV3-2CCS	Tank Platoon Move	Develop the Situation	STRUCCTT-2	<input checked="" type="checkbox"/>
PAMV3-2XCS	Tank Platoon Move	Develop the Situation	Unknown Authc	<input type="checkbox"/>
PMDF1-2CCS	Mechanized Infantry Platoon Defend	Prepare For Defense	STRUCCTT-2	<input checked="" type="checkbox"/>
PMDF3-2CCS	Mechanized Infantry Platoon Defend	Defense of Subsequent BP	STRUCCTT-2	<input checked="" type="checkbox"/>
PMFN1-2CCS	Mechanized Infantry Platoon Fundamentals	Tactical Movement	STRUCCTT-2	<input checked="" type="checkbox"/>
PMFN3-2CCS	Mechanized Infantry Platoon Fundamentals	Defense	STRUCCTT-2	<input checked="" type="checkbox"/>
PMMC2-2CCS	Mechanized Infantry Platoon Movement to Cont	First Contact	STRUCCTT-2	<input checked="" type="checkbox"/>
PMMC3-2CCS	Mechanized Infantry Platoon Movement to Cont	Develop the Situation	STRUCCTT-2	<input checked="" type="checkbox"/>
PSFN1-2CCS	Scout Platoon Fundamentals	Reconnaissance	STRUCCTT-2	<input checked="" type="checkbox"/>
PSZR1-2CCS	Scout Platoon Zone Reconnaissance	Zone Reconnaissance	STRUCCTT-2	<input checked="" type="checkbox"/>
PSZR2-2CCS	Scout Platoon Zone Reconnaissance	Contact with OPFOR Brigade	STRUCCTT-2	<input checked="" type="checkbox"/>
PSZR3-2CCS	Scout Platoon Zone Reconnaissance	Contact With OPFOR CRP an	STRUCCTT-2	<input checked="" type="checkbox"/>
PSZR4-2CCS	Scout Platoon Zone Reconnaissance	Establish Screen	STRUCCTT-2	<input checked="" type="checkbox"/>
PSZR5-2CCS	Scout Platoon Zone Reconnaissance	Security Operations Against	STRUCCTT-2	<input checked="" type="checkbox"/>
RCFN1-2CCS	Cavalry Troop Fundamentals	Reconnaissance	STRUCCTT-2	<input checked="" type="checkbox"/>
RCMC1-2CCS	Cavalry Troop Movement to Contact	Zone Reconnaissance	STRUCCTT-2	<input checked="" type="checkbox"/>
RCMC2-2CCS	Cavalry Troop Movement to Contact	Contact with OPFOR Brigade	STRUCCTT-2	<input checked="" type="checkbox"/>

View Exercise Materials

CITT Overview

How To
Navigate CITT

Learn About
CITT

Produce
Training
Materials

Produce
Exercise Files

Exercise
Management
Tools

The Exercise Management Tools module provides site personnel access to key sections of the CCTT exercise materials.

Exercise Data

PADF1-2CCS

Print Materials

Executable Overlay Data

OPFOR Control Measures

BLUFOR Control Measures

Control Measure

Initialization Point 1

Location

Location

▶ NK080260

*

Record: 1 of 4

System Requirements

Component	Quantity
CES	1
CTCP	1
FDC	1
FSE	1
SAF	3

Exercise Performance Note:

This exercise provides the unit the opportunity to conduct a deliberate occupation of a battle position as well as conduct service station resupply. OPFOR will need to be added to the exercise if the unit wishes to defend from the positions they maintain.

Site Operations Note:

The FSE workstation is needed to provide communications for the CES workstation.

The Exercise Data screen provides site personnel with specific information about a given exercise. This includes the system requirements, executable overlay data, and exercise performance and site operations notes.

Create A New CCTT Exercise

How To Create An Exercise

Begin Create

Print Materials

Create Steps

These are the steps to creating an exercise. You may print this map by selecting the button at the bottom of this box and annotate which steps you have completed. If you must exit during the Create Exercise TSP you can return to your exercise through the Modify an Exercise module of CITT

Print Create Steps

Close Create

Define Mission Set Parameters

- ☐ Establish Initial Settings
- ☐ Select Mission Set Tasks
- ☐ Determine Mission Set Concept
- ☐ Generate OPORD Materials
- ☐ Partition Set Into Exercises

Create Outlines for Exercises in Set

- ☐ Create Exercise Description
- ☐ Create Training Event Diagram
- ☐ Develop Tactical Situation
- ☐ Develop OPFOR and BLUFOR Situation
- ☐ Assign Exercise Tasks and Task Steps
- ☐ Designate Workstations for Exercise

Create Exercise TSP

- ☐ Exercise Concept
- ☐ Exercise Context
- ☐ Event Guide
- ☐ Workstation Execution Guidelines

Complete New Exercise TSP

- ☐ Build Plan Sheets: Manned Module, BLUFOR, OPFOR
- ☐ Proof Exercise TSP

The Create A New CCTT Exercise screen is the first screen in the exercise development process. It outlines all the steps involved in creating an exercise.

Define Mission Set Parameters

Establish Initial Settings

Select Mission Set Tasks

Determine Mission Set Concept

Generate OPORD Materials

Partition into Exercises

Set Echelon:

X

Set Unit:

X

Set Mission:

XX

Set Terrain:

X

Set Difficulty:

X

Set Mode:

X

Set Type:

X

Define the basic parameters for your exercises

?

Previous TAB

Next TAB

Exit Create

The Define Mission Set Parameters screen allows the user to define the foundation for the mission set and helps guide the creation of the exercise within the set. This includes establishing the initial settings, selecting the mission set tasks, determining the mission set concept, generating the OPORD materials, and partitioning into exercises.

Exercise Concept - Create Exercise TSP

CITT Exercise Id: XXXX0-XXXX

Create Event Table

Create Exercise Description

Create Training Event Diagram

Create Environment

Create Workstations

Event
1 First event

Sequence	TaskNumber	Task Name

Record: 14

1

of 2

< Previous

Next >

The Exercise Concept - Create Exercise TSP screen allows the user to convey the concept of the exercise. This section consists of five components; the Event Table, the Exercise Description, the Training Event Diagram, the Environmental conditions, and the Workstation Operator Actions.

C-19

CITT Exercise Id: XXXX0-XXXX

Name:	Exercise Name text
ExerciseDifficulty:	X
Sequence:	0

Plan Sheets

When you press the "NEXT>" button at the bottom of this form you will be taken to the Plan Sheets where you can make modifications or additions to the exercise data.

Exercise TSP

The "NEXT>" button at the bottom of the Modify Plan Sheets form will take you to a form that allows you to view and edit any existing component of the exercise TSP in a format similar to a Word document. If you wish to return to your exercise at a later date and make small, editorial changes, leave the "Complete" box on this form unchecked and use the "Complete Modifications" button from the Modify an Existing Exercise form to return to this exercise. (Note: If the "Complete" box is checked, the "Complete Modifications" button will be disabled.).

Complete

Exercise Performance Note:

This is the default template used as a starting point for creating new exercises.

Validation By:

Previous

Next

Close

The Complete New Exercise TSP screen provides the user the ability to cross-check and verify all entries and make final corrections to the exercise.

APPENDIX D

COMMANDER'S INTEGRATED TRAINING TOOL USER SURVEY

DATA REQUIRED BY THE PRIVACY ACT OF 1974

AUTHORITY: Title 10, USC, Sec 2358.

PRINCIPAL PURPOSE: The purpose of this survey is to collect program evaluation regarding the Commander's Integrated Training Tool for the Close Combat Tactical Trainer. The data collected with this form are to be used for research purposes only.

ROUTINE PURPOSE: This as an experimental data collection form developed by the U.S. Army Research Institute for the Behavioral and Social Sciences pursuant to its research mission as prescribed in AF: 70-1.

DISCLOSURE: Your participation in this research is strictly voluntary. Individuals are encouraged to provide complete and accurate information in the interests of research, but there will be no effect on individuals for not providing all or any part of the information.

Please complete the survey each time you use CITT even if you have completed the survey previously. To complete the survey, click on "OK".

PT 60-18

The information you provide by completing this survey will be used to improve CITT and make it more responsive to the needs of CITT users. To complete the survey type in your response in the area provided or click the check box for the desired alternative.

Your current duty position: _____

Is this your first time using the CITT? Yes_____ No_____

If you said no, approximately how many previous times have you used the CITT?

- _____ 1-2
- _____ 3-5
- _____ 6-10
- _____ more than 10

For what reason did you use CITT during the current session? Select all that apply..

- _____ To learn about CCTT
- _____ To learn about CITT
- _____ To produce training materials
 - _____ To select an exercise
 - _____ To modify an exercise
 - _____ To create an exercise
- _____ To produce exercise files
- _____ To receive system training

Have you viewed "The Senior Leaders Guide to CCTT System and Training Capabilities?" Video

_____ Yes _____ No

If yes, how helpful was the video to your use of the CITT?

- ☐ Extremely helpful
- ☐ Very helpful
- ☐ Somewhat helpful
- ☐ Slightly helpful
- ☐ Not at all helpful

Have you viewed "The Unit Leaders Guide to Training in the CCTT" Video? ☐ Yes ☐ No

If yes, how helpful was the video to your use of the CITT?

- ☐ Extremely helpful
- ☐ Very helpful
- ☐ Somewhat helpful
- ☐ Slightly helpful
- ☐ Not at all helpful

How would you describe your level of experience with using personal computers?

- ☐ Very experienced
- ☐ Moderately experienced
- ☐ Slightly experienced
- ☐ Complete novice

What specifically did you want to accomplish using the CITT during this session? (For example, "Modify exercise PADIF, Create a new exercise, etc.")

Using the CITT, I was able to accomplish what I wanted to do.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree
- ☐ Disagree
- ☐ Strongly disagree

How difficult do you think it is to navigate through the CITT?

- ☐ Extremely easy
- ☐ Very easy
- ☐ Easy
- ☐ Difficult
- ☐ Very difficult
- ☐ Extremely difficult

Navigation tools and buttons are used consistently throughout the CITT.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree
- ☐ Disagree
- ☐ Strongly disagree

If I became "lost" in the CITT, it was usually easy to get back to where I wanted to be.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree
- ☐ Disagree
- ☐ Strongly disagree

Did you use the Help feature of the CITT during this session? Yes ☐ No ☐

If yes, approximately how many times?

- ☐ 1-2
- ☐ 3-5
- ☐ 6-10
- ☐ 10-20
- ☐ more than 20

The built-in CITT "Help" Material is very helpful.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree
- ☐ Disagree
- ☐ Strongly disagree

The "Help" material is written at the correct level for my needs.

- ☐ Strongly agree
- ☐ Agree
- ☐ Neither agree nor disagree
- ☐ Disagree
- ☐ Strongly disagree

Was there any time during this session when you needed "Help" but were unable to obtain it? Yes ☐
No ☐

If Yes, please explain: _____

What feature of the CITT did you find the most useful?

What feature of the CITT did you find least useful?

If you could add a feature to the CITT, what would it be?

Additional comments: _____

APPENDIX E

FORMATIVE EVALUATION DATA COLLECTION FORMS

CITT Test Procedure

Note: Each CITT test will be observed by two observers.

1. One of the two observers will instruct the subject using the appropriate Test Session Introduction.
2. Following the instructions, the subject will be provided with the Test Case for the session.
3. During the test, each observer will record his observations in the CITT Test Observation Booklet in accordance with the Instructions contained in the booklet.
4. Following completion of the Test Case, the subject will complete the CITT on-line survey (for each test case completed)
5. Following completion of all test cases for an individual subject, the observers will conduct a Debriefing Session in accordance with the instructions contained in the CITT Test Debriefing Booklet.

DIRECTIONS FOR USE:

Procedure

Place your name on the front of the booklet. Each FE observer will be provided with his/her individual copy.

At the beginning of each test session, complete the Test Case Identification information. Record the Subject's name, the date, the test case identification, and the start time of the test.

During the test session, record your observations on the portion of the sheet labeled "Observations." Each time the subject accesses "Help", put a tally in the "Help" column at the point in your observation at which Help was accessed. At the completion of the test, record the Stop Time and whether the test was completed successfully. Use as many recording sheets as required for the session.

Rationale

In accordance with the Formative Evaluation plan, we are particularly interested in the time taken to complete each module, the paths the user takes through CITT, whether a successful outcome was reached, the types of navigation problems that occurred, any system errors that occurred, and difficulties the user experienced as he/she used the CITT. (Other FE data will be collected through surveys and interviews.) The goal is to capture as much of the session as practical, however, based on prior user testing, we need to recognize that we can not record every action taken by the subject nor every question/comment made. To facilitate recording, opposite each recording sheet is an Observation Guidance form which contains a shorthand process for recording most CITT actions. For example, if the subject is completing the action Create - ConteXt - Starting Location, you would record this as CX2.

Providing Assistance

At the bottom of the Observation Guidance form is a box labeled Exercise Assistance. This shows the progression of assistance the subject should be provided in the event he/she experiences difficulties with the test. Our overall goal is passive observation, however, based on prior user testing, it is anticipated that assistance will occasionally be required.

When required, observers should provide the minimum assistance necessary. The first action should be to suggest that the subject try the CITT Help. This will often be sufficient to solve the problem. If that is not successful, provide a general hint or assistance. For example, "you might want to consider the task steps you want the unit to perform." If that is still not sufficient, provide a direct instruction. For example, "Go to Select Initial Settings and list the task steps you want the unit to perform."

As assistance is provided during a session, it is important that the details be captured and recorded. We need to note when assistance was required, the nature of the assistance provided, and the extent of the assistance provided. The need for assistance may represent a flaw or weakness in CITT, however, we will not be able to determine this unless we have detailed information on the assistance provided.

OBSERVATION GUIDANCE

Use the following abbreviations for designating CITT actions performed by the user:

<u>N</u> avigate	by <u>R</u> ole	by <u>N</u> eed	
	(1) UnitCDR/Ldr	(1) Learn about CCTT	(6) Plan and Build Ex's
	(2) CCTT Site Staff	(2) Review Ex's	(7) Plan for Training
	(3) USW Operator	(3) Select Ex's	(8) Prepare for Training
	(4) O/C	(4) Modify Ex's	(9) Learn h/t Exec. Training
		(5) Create Ex's	(10) Learn h/t Assess Trng

Learn About CITT

<u>S</u> elect an Exercise	by <u>T</u> ask	by <u>N</u> ame	by <u>C</u> riteria	
<u>R</u> eview an Exercise Summary	<u>O</u> utline	<u>T</u> SP	<u>P</u> lan Sheets	<u>M</u> ission
	<u>M</u> atriX OPOrd	<u>O</u> verlay	<u>T</u> humbnail	
<u>M</u> odify Ex	<u>S</u> elect Init Settings	<u>C</u> oncept	<u>C</u> onteXt	<u>E</u> vent Guide
	(1) Tasks	(1) Ex. Desc.	(1) Tact. Sit.	(1) O/C Action
	(2) Task Steps	(2) TED	(2) Starting Loc	(2) Unit Action
	(3) Events	(3) Environment	(3) Commo Data	(3) Task/Task
<u>S</u> teps	(4) Event Actions	(4) Workstations		(4) Wkstat.
<u>A</u> ctions	(5) Event Tasks			
	<u>W</u> kstat. Exec. Gd	<u>C</u> omplete <u>M</u> od. TSP		
		(1) Plan Sheets		
		(2) Ex. TSP		

<u>C</u> reate Ex	<u>M</u> ission Set Parm		<u>E</u> xercise Outlines	
	(1) Init Settings		(1) Ex. Description	
	(2) Mission Set Tasks		(2) TED	
	(3) Mission Set Concept		(3) Tactical Situation	
	(4) OPOrd Mtls		(4) OPFOR & BLUFOR Sit	
	(5) Partition Set		(5) Ex. Tasks and Task Steps	
			(6) Designate Workstations	
	<u>C</u> oncept	<u>C</u> onteXt	<u>E</u> vent Guide	
	(1) Ex. Desc.	(1) Tact. Sit.	(1) O/C Action	
	(2) TED	(2) Starting Loc	(2) Unit Action	
	(3) Environment	(3) Commo Data	(3) Task/Task Steps	
	(4) Workstations		(4) Wkstat. Actions	
	<u>W</u> kstat. Exec. Gd	<u>C</u> omplete <u>M</u> od. TSP		
		(1) Plan Sheets		
		(2) Ex. TSP		

Produce Exercise Files

Exercise Management Tools

Test Assistance:

1. Maintain passive observation
2. Suggest user review help
3. Provide suggestions (e.g., general information on CITT)
4. Provide specific activity to execute

Sheet _____ of _____

Start Time: _____

Stop Time: _____

Help (tally)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be a standard notebook page or a sheet of stationery. There is no handwriting or other markings on the page.

Yes_____ No_____

Guidelines for Debriefing Session following CITT Test

The debriefing should occur after the subject has completed the on-line CITT survey.

The debriefing supplements the data collected during observation and from the survey and can be used to elaborate on data previously collected. The debriefing should be conducted using a conversational format, however, the general categories listed below should be covered.

1. Follow up on any items/concerns remaining from the CITT test observations, for example, any questions you made note of during the test re: why a subject took a particular action.
2. Ask subject for his overall impression of CITT in terms of:
 - Look and feel
 - Ease of navigation
 - Ease of use
3. Ask subject about the information included in Learn About CITT:
 - Value of the content
 - Readability
 - Use of audio and video
4. Ask subject about the on-line help.
 - Relevance to reason he accessed help
 - Satisfactorily answered his questions
5. Ask subject what, if anything in CITT, made it difficult to complete his task.
6. Ask subject what features of CITT were especially useful.
7. Ask subject what, if anything, he would like to have had in CITT that wasn't included.
8. Ask subject for any other comments he wishes to provide.

CITT Test Subject Debriefing

Session _____This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

DIRECTIONS FOR USE:

Procedure

This booklet contains all of the recording forms for use in the Build/Proof phase of the CITT formative evaluation at Fort Hood. Place your name on the front of the booklet.

The booklet contains three types of forms: recording forms for Build/Proof observations, interview/debriefing recording forms for CLS personnel, and interview/debriefing recording forms for Unit personnel.

Build/Proof Observations

During the Build/Proof activities, record your observations on the forms provided. In accordance with the Formative Evaluation plan, we are interested in whether the exercises selected, modified, or created using CITT support the Build/Proof process. It is not feasible or necessary to provide a contemporaneous record of the Build/Proof process; rather, we are interested in actions and outcomes which were particularly effective or particularly ineffective to the Build/Proof process. The recording forms provide space for the following: a description of the action/outcome; whether the action/outcome was effective or ineffective; and your analysis of the factors (CITT and non-CITT) which contributed to the effectiveness/ineffectiveness of the action/outcome.

CLS Personnel Interview/Debrief

The CLS Personnel Interview/Debrief recording forms contain questions to be used during the debriefing of the site CLS personnel who were involved in the Build/Proof activities. The interview/debriefing will probably require 30-60 minutes and should be conducted as a group.

Unit Personnel Interview/Debrief

The Unit Personnel Interview/Debrief recording forms contain questions to be used during the debriefing of the site CLS personnel who were involved in the Build/Proof activities. The interview/debriefing will probably require 30-60 minutes and should be conducted as a group.

Observation and Interview/Debriefing Guidelines for Build/Proof test

The original conception for this portion of FE was that we would observe, in total, the site personnel building the exercises modified or created by the unit, and that we would observe the site personnel and unit personnel proofing the exercises. It is quite possible that the work the site will have completed prior to the build/proof test will completely confound the results obtained. The exercises will likely have been built prior to the unit's use of CITT. If this is the case, we will need to decide whether, or to what extent, data collected during this week are usable. Ideally, we will collect the following three types of data:

1. Observation of the Build/Proof process. This observation will be conducted using a significant incident approach. That is, the observer will look for and record actions/events which occur that are not part of a standard build/proof process; rather, they represent things that worked particularly well or particularly poorly. The observer will not attempt to conduct contemporaneous observation. Observations will be recorded in the Build/Proof Data Recording Booklet.
2. Interview/debriefing data from CCTT CLS personnel involved in the Build/Proof test. Interview notes will be recorded in the Build/Proof Data Recording Booklet.
3. Interview/debriefing data from Unit personnel involved in the Build/Proof test. Interview notes will be recorded in the Build/Proof Data Recording Booklet.

Build/Proof Observation Form

Action/Outcome: _____

____ Effective ____ Ineffective

Contributing factors: _____

Action/Outcome: _____

____ Effective ____ Ineffective

Contributing factors: _____

Guidelines for Unit Personnel Debriefing Session following Build/Proof Test

The debriefing should occur after the Build/Proof of all exercises have been completed.

The debriefing supplements the data collected during the Build/Proof observation. The debriefing should be conducted as a group activity using a conversational format, however, the items listed below should be covered.

1. Follow up on any items/concerns remaining from the Build/Proof observations.
2. Ask the following:
 - Overall impression of the Build/Proof process using exercises produced with CITT.
 - Was this your first experience with Building/Proofing CCTT exercises?
 - Were all necessary materials for the Build/Proof produced by CITT?
 - What materials were missing?
 - Did the CITT provide you with the information you needed to participate effectively in the Build/Proof process?
 - Did the exercise materials produced by CITT support the Build/Proof process?

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Guidelines for CLS Personnel Debriefing Session following Build/Proof Test

The debriefing should occur after the Build/Proof of all exercises have been completed.

The debriefing supplements the data collected during the Build/Proof observation. The debriefing should be conducted as a group activity using a conversational format, however, the items listed below should be covered.

1. Follow up on any items/concerns remaining from the Build/Proof observations.
2. Ask the following:
 - Overall impression of the Build/Proof process using exercises produced with CITT.
 - Were all necessary materials for the Build/Proof produced by CITT?
 - What materials were missing?
 - Were the materials provided in a format that supported the Build/Proof process?
 - Were there any problems with Building/Proofing the exercises? If so, what were they?
 - What, if any, relationship to these problems have to CITT?
 - Was the Build/Proof process easier, more difficult, or about the same for exercises produced using the CITT compared to other exercises you have done?

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Observation and Interview/Debriefing Guidelines for Exercise Execution

The purpose of this part of the CITT Formative Evaluation is to determine through observation and interviews whether or not the unit was able to successfully execute the exercises that had been developed using CITT. We will collect the following types of data:

1. Observation of the Exercise Execution process. The [Formative Evaluation] Test plan for CITT specifies that we will collect data on difficulties encountered/errors that occurred during Exercise Execution. We will combine observation with a modified significant incident reporting technique to accomplish this. That is, the observer(s) will look for and record events that occurred and that indicate difficulties/errors with the execution process. The observer will not attempt to conduct contemporaneous observation. Observations will be recorded in the Exercise Execution Data Recording Booklet.
2. Interview/debriefing data from CCTT CLS and Unit personnel involved in the Exercise Execution test. Interview notes will be recorded in the Exercise Execution Data Recording Booklet.

DIRECTIONS FOR USE:

Procedure

This booklet contains the recording forms for use in the Exercise Execution phase of the CITT formative evaluation at Fort Hood. Place your name on the front of the booklet.

The booklet contains two types of forms: recording forms for Exercise Execution observations, and interview/debriefing recording forms for CLS and Unit personnel.

Exercise Execution Observations

During the Exercise Execution activities, record your observations on the forms provided. In accordance with the Formative Evaluation plan, we are interested in whether the Unit was able to successfully execute the exercises selected, modified, or created using CITT. It is not feasible or necessary to provide a contemporaneous record of the Exercise Execution process; rather, we are interested in actions and outcomes which indicate difficulties or errors in the execution of the exercises. The recording forms provide space for the following: a description of the error/difficulty, and your analysis of the factors (CITT and non-CITT) which contributed to the difficulty/error.

CLS and Unit Personnel Interview/Debrief

The CLS and Unit Personnel Interview/Debrief recording forms contain questions to be used during the debriefing of the site CLS and Unit personnel who were involved in the Exercise Execution activities. The interview/debriefing will probably require 30-60 minutes and should be conducted as a group.

Guidelines for CLS and Unit Personnel Debriefing Session following Exercise Execution

The debriefing should occur after the Exercise Execution of all exercises have been completed.

The debriefing supplements the data collected during the Exercise Execution observation. The debriefing should be conducted as a group activity using a conversational format, however, the items listed below should be covered. Note: a given item may be more relevant to one group of participants than to others.

1. Follow up each difficulty/error recorded from the Exercise Execution observations.
Determine what the CLS and Unit personnel thought went wrong and whether the problem can be related to CITT (i.e., would the difficulty/error have occurred in any event or did it occur as a result of CITT having been used to develop the exercise and/or train the Unit personnel)?
2. Ask the following:
 - For each Unit Support Workstation Operator, did the training they received in CITT adequately prepare them to support the exercises? If not, ask for specific examples of lack of preparation or lack of required knowledge?
 - Did the exercises as executed adequately match the exercises as “intended” when they were developed in CITT? If not, ask for specific instances or examples of a mismatch. How are the mismatches related to the CITT (e.g., CITT provided incorrect information, insufficient information, etc.)?
 - What, if any, features/functions of the CITT were particularly helpful in the execution of the exercises?
 - What, if any, features/functions of the CITT created particular difficulties in the execution of the exercises?
 - Having gone through exercise selection/modification/creation, build/proof, and execution, what is their overall impression of CITT?
 - What would they most like to see added to CITT?
 - What could be removed from CITT?

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal black lines running across the width of the page. The lines are thin and consistent in thickness. There are no margins, text, or other markings on the paper.

APPENDIX F

CITT IMPROVEMENTS IMPLEMENTED

These are refinements that can be accomplished within the CITT project time frame. They are based on findings from formative evaluation.

1. Help needs to link to the FM's.
2. In Help, the contents tab in the treeview frame is broken. It does not display contents – instead it links to “How to select an Exercise”.
3. There are other links that are broken.
4. The OPORD link was broken – test participant's OPORD was saved, but was not associated with the exercise he was creating.
5. In the IO, make the bullets hyperlinks. Users click them expecting them to link to the topic.
6. In the IO, Forward and Back still do not always work as expected.
7. The blank Matrix OPORD in the CREATE has some formatting applied to the fields (e.g., Some are bold, etc.) Clean up the formatting.
8. Fill in all “Note” fields for existing exercises.
9. For screens that use tabs (Workstation Execution Guidelines, etc.), make the tabs stand out. Many test subjects missed the tabs.
10. System Requirements Table is not accurate.
11. The IO index is missing a lot of key words. Redo the index.
12. In IO, change “Click < to view” to “Click the < button above to view.”
13. Eliminate the screen numbers from the title bar.
14. Make the exit button from IO more obvious.
15. Simplify the select screen. Perhaps give the select options on the first screen, then have following screens.
16. On the Plan Sheet, under Marksmanship, replace current values with those used in CCTT.
17. In Review Exercise TSP, the Titles of all four sections should be included at the top of the screen with the selected one grayed out.

18. Disable Print from the toolbar.
19. Change "Done" to "Completed" on the Select Screen.
20. In OPORD, if you have multiple annexes, make them links.
21. In IO, fix the picture of the guy who's going to get his elbow cut off (it is in Characteristics of Structured Training).
22. In Create Mission Set, the user can inadvertently create a single exercise mission set (one of the test participants did) and there's no way to correct it. A couple of possibilities: have the default value for the partition box be 0 so that user has to enter something. Or ask for a confirmation when they select the number of exercises in the set.
23. In Workstation Actions, expand the text box. Users thought they only had one line to enter text.
24. Delete the drop down list for Unit ID in Plan Sheets.
25. In IO, the Treeview frame should always come up in Contents mode the first time the user accesses IO.
26. Correct "sheath" to "sheaf" in IO where it talks about FABTOC/AFATDS.
27. Change "The commander enters fire support data ..." to read "The FDO enters fire support data...". This is in the FABTOC/AFATDS portion of the IO.
28. Check to make sure we always use AFATDS, not AFTADS. (In the IO part on FABTOC/AFATDS).

APPENDIX G

CITT IMPROVEMENTS TO BE IMPLEMENTED

These are based on formative evaluation and other design considerations. They represent modifications and enhancements that can not be implemented in the prototype CITT.

1. Allow user to select multiple tasks or task steps simultaneously versus having to select them one at a time and going back to the drop down list each time.
2. Provide the capability for the user to review TSP materials by role.
3. Provide the capability for users to print TSP materials by role. This will allow users to print only the portions of the TSP they need to execute exercises.
4. Provide the capability for users to print selected portions of the TSP to include individual pages.
5. Redesign the way users add or delete units in exercises. Make the activity more closely resemble either a task organization chart or an MCC like screen. Have this activity automatically build plan sheets and the exercise initialization file for the exercise.
6. Provide a simple activity for the user to add or modify "relocatables" such as obstacles and fighting positions. Integrate this activity with the map tools and have it automatically populate the plan sheets and the exercise initialization file for the exercise.
7. Provide the capability to create the TED by cropping the overlay and map created for the exercise set.
8. Provide the capability to associate existing overlay files with new exercises.
9. Make the create activity a multi-session activity.
10. Provide an option for modifying exercise sets vice just individual exercises.
11. Provide the capability to update Training Event Diagrams when modifying the operations overlay.
12. In Plan Sheets and Starting locations -- do not list the M1A2 as an option; provide look-up tables in future CITT.
13. Allow the user to copy an exercise to a floppy so he can take to another machine.
14. Add scroll bars where full text is not displayed, even when that field is not the focus.
Requires Visual Basic.

15. Redesign Plan Sheets based on task organizing. This will require adding task guidance. Include mobility/survivability.
16. Re-engineer Create and Modify to be more user oriented, i.e., use military terms and make it more like METT-T.
17. Add tutorials for Create and Modify that actually complete an exercise creation or modification as the user completes the tutorial.
18. Design/redesign CITT for users other than commanders.
19. Provide an "undo" button.
20. Do not allow the user to exit Access using the X button. Provide an intercept message asking for confirmation.
21. Redesign the Select screen (which actually involves redesign of the selection process.)
22. Redesign the "triptik" that is generated in the Navigate screen. Include links to the appropriate content and activities. Customize for the various users (i.e., do not just have a "Workstation operator" option, but make it the "FABTOC Workstation operator."
23. Include overlays for all exercises.
24. Provide for force on force exercises.
25. Examine and revise the Event Guide to simplify.
26. All Object Linking and Embedding objects (training event diagrams, Matrix Opord, Overlay, Commo Matrix, SOI Extract) need to be broken-down into data elements and normalized into the table structure. CITT 2 should not contain any embedded objects or hyperlinks to external programs.
27. Lookup tables need to be developed and populated for the Plan Sheet fields: System, Unit ID, Unit Type and Equipment ID. Each table needs to have restrictive criteria identified and specific fields created.
28. TRADOC Educational System code for interpreting map location of graphic elements needs to build a link between the Training Event Diagram and the Plan Sheets, and if possible, Training Event Diagram graphics would be constructed from data stored in tblPlanSystem (also possibly Overlays—but this would need additional research owing to the structural differences as the Plan Sheets relate to the exercise and the Overlay relates to the Set).
29. Access 2000 needs to be assessed for both front end and back end capabilities before development is moved to SQL and Visual Basic.

30. *(If front-end is VB)* All CITTSA forms need to be redesigned in Visual Basic 6.0. Subforms must be designed unique to one parent form to eliminate the problem of topic-specific help with subforms. Forms that show the event guide and the workstation operator guidelines should be reconstructed with the assumption that VB will allow more than two embedded subforms. The form to add actions for an event would not be necessary. The Plan Sheets need to be redesigned to accommodate removing the ammunition fields from tblPlanSystem and normalizing them into one field in a child table.
31. *(If front-end is Access 2000)* Queries that were developed just to provide a sort order to data displayed on forms need to be deleted, forms sourced to a table and the Form_Load event needs to include "OrderByOn = True."
32. *(If front-end is Access 2000)* Remove the close, min and max buttons from forms (except for dialogs).
33. Access Replication technology (or the SQL equivalent) needs to be implemented to allow exercises created on one copy of CITT to be integrated into the central database.